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(54) Title: CROP-SELECTIVE HERBICIDAL SULFONAMIDES

(57) Abstract

This invention relates to novel sulfonamides and their use as crop selective herbicides. Compounds of the instant invention have demonstrated excellent control of weeds coupled with corn safety.

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TITLE

CROP-SELECTIVE HERBICIDAL SULFONAMIDES

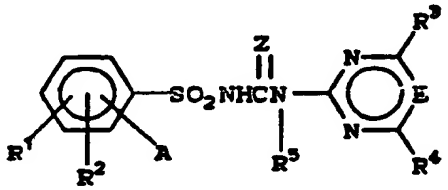
CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation-in-part of application Serial No. 07/503,182, filed April 4, 1990.

BACKGROUND OF THE INVENTION

This invention relates to novel sulfonamides and their use as crop selective herbicides. Compounds of the instant invention have demonstrated excellent control of weeds coupled with corn safety.

EP-A-120,814 discloses herbicidal sulfonylureas of the formula



wherein:

A is C_1-C_6 haloalkyl;

R^1 is H, halogen, NO_2, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 alkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 alkylsulfonyl, COR^6, NR^7R^8, $CONR^9R^{10}$ or $SO_2NR^{11}R^{12}$; and

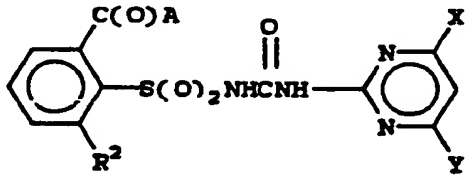
R^6 is C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_2-C_6 alkoxyalkoxy, hydrogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Although this reference broadly embraces compounds of the instant invention, it does not teach or suggest these particular compounds or their herbicidal utility.

Additionally, a need still exists for herbicides because of world-wide food shortages. In addition, herbicides which are selective to important crops such as corn are particularly necessary. According to the instant invention, such compounds have been found.

SUMMARY OF THE INVENTION

More specifically, this invention comprises novel compounds of Formula I, agriculturally suitable compositions containing them, and their method-of-use as preemergence and/or postemergence herbicides or plant growth regulants:



I

wherein:

A is OR^1 or $N(CH_3)_2$;

R^1 is C_1-C_3 alkyl, $CH_2CH{=}CH_2$, $CH_2C{\equiv}CH$, CH_2CH_2Cl or $CH_2CH_2OCH_3$;

R^2 is CH_2F, CHF_2, $CHFCH_3$ or CH_2CN;

X is CH_3 or OCH_3; and

Y is H, Cl, CH_3, C_2H_5, OCH_3 or OCF_2H;

and their agriculturally suitable salts; provided that when Y is Cl, then X is OCH_3.

In the above definitions, the term "alkyl" denotes straight chain or branched alkyl, e.g.

methyl, ethyl, n-propyl or isopropyl. The total number of carbon atoms in a substituent group is indicated by the C_i-C_j prefix where i and j are numbers 1 to 3. For example, C_1-C_3 alkyl would designate methyl through propyl (both n-propyl and isopropyl).

Preferred for reasons of increased ease of synthesis and/or greater herbicidal efficacy and/or crop safety are:

1. Compounds of Formula I wherein
   A is OR^1; and
   R^1 is CH_3, CH_2CH_3 or $CH(CH_3)_2$.
2. Compounds of Preferred 1 where
   when one of X and Y is CH_3, then the other of X and Y is other than OCH_3.

Specifically preferred for reason of greatest safety to corn (maize) is:

- Methyl 3-(cyanomethyl)-2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]benzoate (Formula I: A is OR^1, R^1 is CH_3, R^2 is CH_2CN, X and Y are CH_3.

Specifically Preferred for reason of greatest safety to corn, wheat and barley are:

- Methyl 2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-3-(cyanomethyl)benzoate (Formula I: A is OR^1, R^1 is CH_3, R^2 is CH_2CN, X is OCH_3, Y is Cl);
- Methyl 3-(cyanomethyl)-2-[[[[[(4-(difluoromethoxy)-6-methoxy-2-pyrimidinyl]-amino]carbonyl]amino]sulfonyl]benzoate (Formula I: A is OR^1, R^1 is CH_3, R^2 is CH_2CN, X is OCH_3, Y is OCF_2H);
- Methyl 3-(difluoromethyl)-2-[[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-

benzoate (Formula I: A is OR^1, R^1 is CH_3, R^2 is CHF_2 X is OCH_3, Y is H);

- Methyl 3-(fluoromethyl)-2-[[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate (Formula I: A is OR^1, R^1 is CH_3, R^2 is CH_2F, X is OCH_3, Y is H).

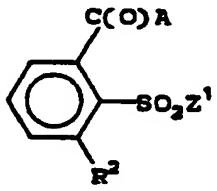
Specifically preferred for reason of greatest safety to wheat and barley is:

- Methyl 2-[[[[(4,6-dimethoxy-2-pyrimidinyl)-amino]carbonyl]amino]sulfonyl]-3-(fluoromethyl)benzoate (Formula I: A is OR^1, R^1 is CH_3, R^2 is CH_2F, X and Y are OCH_3).

Specifically preferred for reason of greatest safety to corn, wheat, barley and rice is:

- Ethyl 2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-3-(fluoromethyl)benzoate (Formula I: A is OR^1, R^1 is CH_2CH_3, R^2 is CH_2F, X is OCH_3, Y is Cl).

This invention also comprises novel compounds, such as the sulfonyl benzoates of Formula II, useful as intermediates for preparation of the compounds of Formula I:



II

wherein:

A is OR^1 or $N(CH_3)_2$;

R^1 is C_1-C_3 alkyl, $CH_2CH=CH_2$, $CH_2C\equiv CH$, CH_2CH_2Cl or $CH_2CH_2OCH_3$;

R^2 is CH_2F, CHF_2, $CHFCH_3$ or CH_2CN; and

Z^1 is Cl or $NHSiR^3R^4R^5$;

R^3 is C_1-C_4 alkyl;

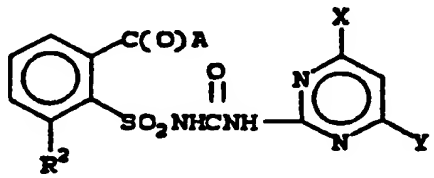
R^4 is C_1-C_4 alkyl; and

R^5 is C_1-C_4 alkyl.

Preferred for reason of increased herbicidal activity of final products of Formula I, are intermediates of Formula II wherein A is OR^1 and R^1 is C_1-C_2 alkyl.

Preferred for reason of increased ease of synthesis are intermediates of the above preferred wherein R^3 and R^4 are CH_3 and R^5 is $C(CH_3)_3$.

DETAILED DESCRIPTION OF THE INVENTION



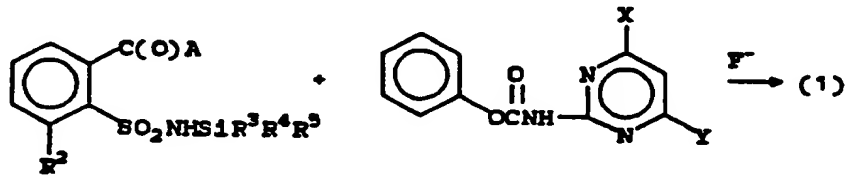
(1)

SYNTHESIS

The compounds of Formula (1), which corresponds to Formula I, can be prepared by one or more of the methods described below. The proper choice of reaction sequences for a given compound will be known to one skilled in the art.

As shown in Equation 1, many of the compounds of Formula (1) are prepared by reacting a silyl sulfonamide of Formula (2) with a pyrimidine carbamate of Formula (3). R^3, R^4, and R^5 are independently C_1 to C_4 alkyl.

Equation 1

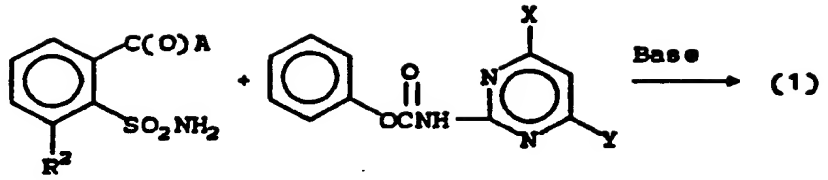


(2) (3)

The reaction is carried out at 0°C to 50°C in a solvent such as acetonitrile, dioxane, or tetrahydrofuran; in the presence of a fluoride ion source such as cesium fluoride, or tetrabutylammonium fluoride for 0.1 to 2 hours. A catalytic amount of base, such as 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU), increases the reaction rate.

Alternatively, some of the sulfonamides of Formula (4) can be prepared and reacted with pyrimidine carbamates of Formula (3) to give compounds of Formula (1) as shown in Equation 2. The reaction is carried out at 0°C to 50°C in a solvent, such as acetonitrile, dioxane, or tetrahydrofuran, in the presence of a non-nucleophilic base, such as DBU for 0.2 to 2 hours. U.S. Patent 4,604,131 discloses details for similar reactions and is herein incorporated by reference.

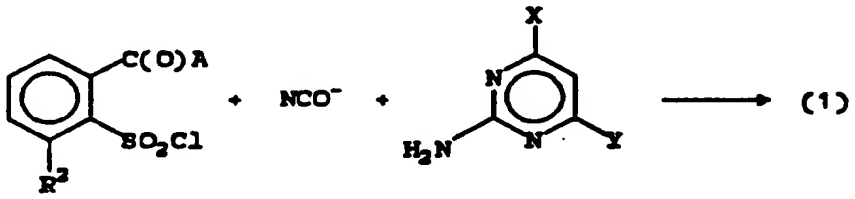
Equation 2



(4) (3)

Sulfonyl chlorides of Formula (5) may be reacted with cyanate anion in the presence of pyrimidine amines of Formula (6) to give compounds of Formula (1) as shown in Equation 3.

Equation 3



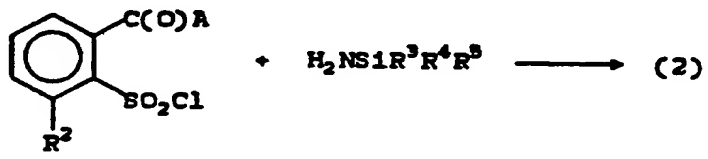
(5) (6)

The reaction is carried out by mixing one equivalent of sulfonyl chloride (5), pyrimidine amine (6), a metal cyanate, such as potassium cyanate, and a catalytic amount of an amin bas , such as Aliquat 336 (Tricaprylymethylammonium chlorid), in a solvent such as acetonitrile for 0.2 to 10 days.

Alternatively, one can use a tetraalkylammonium cyanate, such as tetraethylammonium cyanate, to effect this reaction by the method described in U.S. Patent 4,604,131 herein incorporated by reference.

Silyl sulfonamides of Formula (2) are prepared by reacting sulfonyl chlorides of Formula (5) with a trialkylsilyl amine of Formula (7), such as t-butyldimethylsilyl amine, as shown in Equation 4.

Equation 4



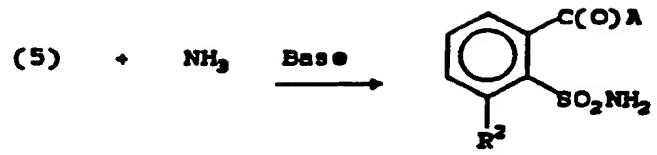
(5) (7)

The reaction is carried out at 0°C to 30°C in a solvent, such as dichloromethane, in the presence of 1 to 2 equivalents of the amine and 1 equivalent of a bicarbonate. J. R. Bowser et. al. describe methods to prepare silyl amines of Formula (7) in Inorganic Chemistry 17, 1882 (1978).

The sulfonyl chlorides of Formula (5) and the silyl sulfonamides of Formula (2) correspond to the intermediates of Formula II.

Sulfonyl chlorides of Formula (5) can be reacted with no more than 2 equivalents of ammonia r, alternativ ly, 1 quival nt of ammonia and 1 equivalent f a bas to give sulfonamides f Formula (4) as outlined in Equation 5.

Equation 5

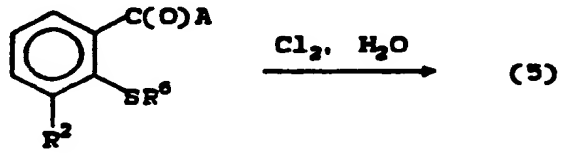


(4)

Sulfonamides of Formula (4) tend to be unstable and can be difficult to isolate.

Sulfonyl chlorides of Formula (5) are prepared by the methods shown in Equations 6 and 7. Sulfur-containing compounds of Formula (8) are oxidized with chlorine as shown in Equation 6. R^6 is H, alkyl, benzyl or carbamoyl.

Equation 6



(8)

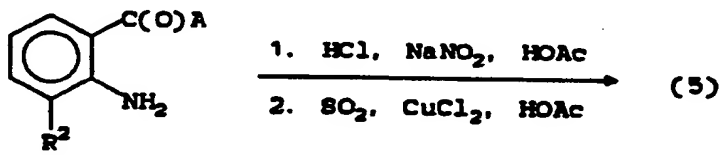
The reaction of Equation 6 is carried out by contacting compounds of Formula (8) in a solvent, such as acetic acid or propionic acid, with at last

3.0 equivalents f chlorine in the presence of at least 2.5 equivalents of water for 0.2 to 5 hours at -20°C to 30°C. A. Wagenaar teaches specific reaction conditions for related compounds in Recl. Trav. Chim. Pays-Bas 101, 91 (1982).

Alternatively, reaction of compounds of Formula (8), where R^6 is H or benzyl, with a hypochlorite solution, such as 5% NaOCl, can provide sulfonyl chlorides of Formula (5). Reaction conditions for similar reactions are obvious to one skilled in the art and are described in EP-A-142,152.

As shown in Equation 7, below, sulfonyl chlorides of Formula (5) may be prepared from the corresponding anilines of Formula (9) by a Meerwein reaction.

Equation 7



(9)

The aniline is diazotized and then reacted with sulfur dioxide and cupric chloride analogous to the teachings of Yale and Sowinski, J. Org. Chem. 25, 1824 (1960). Alternatively, the hydrochloride salts of anilines of Formula (9) can be diazotized in an organic solvent with an alkyl nitrite and react d with sulfur dioxid to giv sulfonyl chlorid s (5) analogous to the t achings of M. Doyl , J. Org. Chem. 42, 2426,2431 (1977).

The pyrimidine carbamates of Formula (3) and the pyrimidine amines of Formula (6) are prepared by the methods described and referenced in EP-A-72,347, EP-A-164,269, EP-A-173,498, U.S. Patent 4,540,782, and U.S. Patent 4,666,506, herein incorporated by reference.

Agriculturally suitable salts of compounds of Formula I are also useful herbicides and can be prepared in a number of ways known to the art. For example, metal salts can be made by contacting compounds of Formula I with a solution of an alkali or alkaline earth metal salt having a sufficiently basic anion (e.g., hydroxide, alkoxide, carbonate or hydroxide). Quaternary amine salts can be made by similar techniques.

Salts of compounds of Formula I can also be prepared by exchange of one cation for another. Cationic exchange can be effected by direct contact of an aqueous solution of a salt of a compound of Formula I (e.g., alkali or quaternary amine salt) with a solution containing the cation to be exchanged. This method is most effective when the desired salt containing the exchanged cation is insoluble in water and can be separated by filtration.

Exchange may also be effected by passing an aqueous solution of a salt of a compound of Formula I (e.g., an alkali metal or quaternary amine salt) through a column packed with a cation exchange resin containing the cation to be exchanged for that of the original salt and the desired product is eluted from the column. This method is particularly useful when the desired salt is water-soluble, e.g., a potassium, sodium or calcium salt.

Acid addition salts, useful in this invention, can be obtained by reacting a c mpound f Formula I

with a suitabl acid, .g., p-toluenesulfonic acid, trichloroacetic acid or the like.

The preparation of the compounds of this invention is further illustrated by the following specific examples. Temperatures are reported in degrees Celsius; abbreviations for nuclear magnetic resonance (NMR) are: s = singlet, d = doublet, t = triplet, m = multiplet, and peak positions are reported as parts per million downfield from internal tetramethylsilane. Infrared (IR) peak positions are given in reciprocal centimeters (cm^{-1}) and sh denotes a shoulder.

EXAMPLE 1

Methyl 3-(Cyanomethyl)-2-nitrobenzoate

To a stirred solution of potassium cyanide (6.2 g) in methanol (100 mL) and water (150 mL) at 0°C was added an acetonitrile solution of methyl 3-(bromomethyl)-2-nitrobenzoate (24.9 g). A catalytic amount of 18-crown-6 ether was then added. After stirring overnight at room temperature, the reaction was extracted with ethyl acetate. The combined extracts were washed with a brine solution, dried over magnesium sulfate, filtered, concentrated, and chromatographed on silica gel eluting with 20% ethyl acetate in hexanes to give 8.5 g of the title compound as a white solid.

90 MHz NMR ($CDCl_3$) δ: 3.83 (s, 2H, CH_2);
3.93 (s, 3H, CH_3); and
7.9 (m, 3H, arom.)

EXAMPLE 2

2-(Methoxycarbonyl)-6-(cyanomethyl)-benzenesulfonyl Chloride

To a stirred suspension of dry tetrahydrofuran (150 mL) and 26% potassium hydrid in oil (6.66 g) was slowly add d benzyl mercaptan (4.82 mL) at 0°C und r a nitrogen atmospher . Aft r 15 minut s, methyl

3-(cyanomethyl)-2-nitrobenzoate (8.5 g) was added and the resulting mixture was stirred at room temperature overnight. The reaction was contacted with 6N sodium hydroxide (25 mL) and extracted with ethyl acetate. The extracts were washed with a brine solution, dried over magnesium sulfate, filtered, and concentrated to give 9.0 g of crude methyl 3-(cyanomethyl)-2-(phenylmethylthio)benzoate as a purple oil.

The crude thioether was stirred in a mixture of dichloromethane (200 mL) and 6N hydrochloric acid (25 mL) at 0°C, as 5% sodium hypochlorite (180 mL) was slowly added. The reaction mixture was then stirred at 0°C for 2 hours. The dichloromethane layer was washed with water, dried over magnesium sulfate, filtered, concentrated, and chromatographed on silica gel eluting with 25% ethyl acetate in hexanes to give 1.7 g of the title compound as a yellow solid.

90 MHz NMR ($CDCl_3$) δ: 3.98 (s, 3H, CH_3);
4.41 (s, 2H, CH_2); and
7.83 (m, 3H, arom.).

EXAMPLE 3

Methyl 3-(Cyanomethyl)-2-[[[(1,1-dimethylethyl)-dimethylsilyl]aminolsulfonyl]benzoate

A suspension of 2-(methoxycarbonyl)-6-(cyanomethyl)benzenesulfonyl chloride (10.7 g), amino-t-butyldimethylsilane (10.3 g), and sodium bicarbonate (3.36 g) in dichloromethane (200 mL) was stirred at room temperature in a stoppered flask for 4 days. The organic phase was washed with with water, dried over magnesium sulfate, filtered, concentrated, and chromatographed on silica gel eluting with 30% ethyl acetate in hexanes to give 5.0 g of th titl compound as a yellow s lid, m.p. 113-115°C.

90 MHz NMR ($CDCl_3$) δ: 0.32 (s, 6H, $SiCH_3$);
0.95 (s, 9H, $C(CH_3)_3$);

3.99 (s, 3H, OCH_3);
4.42 (s, 2H, CH_2CN);
5.91 (s, 1H, NH);
7.6 (m, 2H, arom.); and
7.8 (m, 1H, arom.).

IR (mineral oil) 3290, 2250, and 1710 cm^{-1}.

EXAMPLE 4

Methyl 3-(Cyanomethyl)-2-[[[[(4,6-dimethyl-2-pyrimidinyl)aminolcarbonyllaminolsulfonyllbenzoate

A mixture of methyl 3-(cyanomethyl)-2-[[[(1,1-dimethylethyl)dimethylsilyl]amino]-sulfonyl]benzoate (0.34 g), O-phenyl-N-(4,6-dimethyl-2-pyrimidinyl)carbamate (0.24 g), and acetonitrile (2.5 mL) were stirred and cooled in an ice-acetone bath. A stock solution of 1 M tetrabutylammonium fluoride containing 8 mole % 1,8-diazabicyclo-[5.4.0]undec-7-ene (1.0 mL) was added and the reaction was stirred under a nitrogen atmosphere for 45 minutes. The reaction was added to water (30 mL) and acidified to pH 5 with 1N hydrochloric acid. The resulting precipitate was filtered, washed with water and hexanes, and air dried to give 0.23 g of the title compound as a yellow solid, m.p. 182-185°C.

200 MHz NMR (DMSO) δ: 2.40 (s, 6H, CH_3);
3.79 (s, 3H, OCH_3);
4.67 (s, 2H, CH_2CN);
7.04 (s, 1H, pyrim. H);
7.64 (m, 1H, arom.);
7.82 (m, 2H, arom.);
10.8 (s, 1H, NH); and
13.7 (s, 1H, NH).

IR (mineral oil) 2240, 1740 cm^{-1}.

EXAMPLE 5

Methyl 3-Formyl-2-nitrobenzoate

Methyl 3-(dibromom thyl)-2-nitrob nzoat (62.6 g), silv r nitrat (109 g), 1,2-dim thoxy than (500

mL), and water (400 mL) were heated at reflux overnight. The undissolved salts were filtered off and the filtrate was extracted with ethyl acetate. The extracts were washed with a brine solution, dried over magnesium sulfate, filtered, and concentrated to give a crude solid. Recrystallization from chlorobutane gave 20.9 g of the title compound as an orange solid.

90 MHz NMR ($CDCl_3$) δ: 3.98 (s, 3H, OCH_3);
7.8 (m, 1H, arom.);
8.3 (m, 2H, arom.); and
10.0 (s, 1H, HCO).

EXAMPLE 6

Methyl 3-(Difluoromethyl)-2-nitrobenzoate

To a solution of diethylaminosulfur trifluoride (11 mL) in dichloromethane (75 mL) stirred at -70°C under a nitrogen atmosphere, was added a dichloromethane solution of methyl 3-formyl-2-nitrobenzoate (5.9 g). The reaction was allowed to warm to room temperature. After 3 hours it was poured onto ice (300 mL) and extracted with dichloromethane. The extracts were washed with water, dried over magnesium sulfate, filtered, and concentrated to give a crude solid. Recrystallization from hexanes-chlorobutane gave 3.94 g of the title compound as a peach-colored solid, m.p. 66-69°C.

90 MHz NMR ($CDCl_3$) δ: 3.94 (s, 3H, OCH_3);
6.87 (t, 1H, CHF_2); and
7.9 (m, 3H, arom.).

EXAMPLE 7

2-(Methoxycarbonyl)-6-(difluoromethyl)-benzenesulfonyl Chloride

To a stirred suspension of dry tetrahydrofuran (250 mL) and 26% potassium hydride in oil (6.17 g) was slowly added benzyl mercaptan (4.63 mL) at 0 C under a nitrogen atmosphere. After 15 minutes,

methyl 3-(difluor methyl)-2-nitrobenzoate (7.5 g) was added, and the resulting mixture was stirred at room temperature overnight. The reaction was contacted with aqueous sodium bicarbonate (50 mL) and extracted with ethyl acetate. The extracts were dried over magnesium sulfate, filtered, and concentrated to give 10.8 g of crude methyl 3-(difluoromethyl)-2-(phenylmethylthio)benzoate as a brown oil.

The crude thioether was stirred in a mixture of dichloromethane (400 mL) and 6N hydrochloric acid (28 mL) at 0°C, as 5% sodium hypochlorite (204 mL) was slowly added. The reaction mixture was stirred at 0°C for 2.5 hours. The dichloromethane layer was washed with water, dried over magnesium sulfate, filtered, concentrated, and triturated with hexanes to give 5.17 g of the title compound as a yellow solid.

90 MHz NMR ($CDCl_3$) δ: 4.13 (s, 3H, OCH_3); and
7.1 - 8.3 (m, 4H, CHF_2 and arom.).

EXAMPLE 8

Methyl 3-(Difluoromethyl)-2-[[[(1,1-dimethylethyl)dimethylsilyl]amino]sulfonyl]benzoate

A suspension of 2-(methoxycarbonyl)-6-(difluoromethyl)benzenesulfonyl chloride (5.17 g), amino-t-butyldimethylsilane (4.9 g), and sodium bicarbonate (1.5 g) in dichloromethane (150 mL) was stirred at room temperature in a stoppered flask for 4 days. The organic phase was washed with water, dried over magnesium sulfate, filtered, concentrated, and chromatographed on silica gel eluting with 10 % ethyl acetate in hexanes to give 2.23 g of the title compound as a white solid.

90 MHz NMR ($CDCl_3$) δ: 0.2 (s, 6H, $SiCH_3$);
0.87 (s, 9H, $C(CH_3)_3$);
3.90 (s, 3H, OCH_3);

5.88 (s, 1H, NH); and
7.20 - 8.36 (m, 4H, CHF_2 and arom.).

EXAMPLE 9

Methyl 3-(Difluoromethyl)-2-[[[[(4-methoxy-2-pyrimidinyl)aminolcarbonyllaminolsulfonyllbenzoate

A mixture of methyl 3-(difluoromethyl)-2-[[[(1,1-dimethylethyl)dimethylsilyl]amino]sulfonyl]-benzoate (0.22 g), O-phenyl-N-(4-methoxy-2-pyrimidinyl)carbamate (0.15 g), and acetonitrile (2.0 mL) were stirred and cooled in an ice-acetone bath. A stock solution of 1 M tetrabutylammonium fluoride containing 8 mol % 1,8-diazabicyclo-[5.4.0]undec-7-ene (0.61 mL) was added, and the reaction was stirred under a nitrogen atmosphere for 1 hour. The reaction was added to water (30 mL) and acidified to pH 5 with 1N hydrochloric acid. The resulting precipitate was filtered, washed with water and hexanes, and air dried to give 0.06 g of the title compound as a white solid, m.p. 178-180°C (decomposition).

200 MHz NMR (DMSO) δ: 3.94 (s, 3H, OCH_3);
4.14 (s, 3H, OCH_3);
6.87 (d, 1H, pyrim. H);
7.8 - 8.2 (m, 3H, arom.);
8.43 (d, 1H, pyrim. H);
11.46 (s, 1H, NH); and
13.90 (s, 1H, NH).

IR (mineral oil) 1730, 1720 cm^{-1}.

EXAMPLE 10

Methyl 3-(1-Hydroxyethyl)-2-nitrobenzoate

Titanium tetrachloride (6.25 mL) was added to dry diethylether (250 mL) at -78°C and was stirred under a nitrogen atmosphere. The resulting yellow suspension was allowed to warm to -50°C and was recooled to -78°C prior to adding 1.4 molar

methyllithium in diethylether (41.6 mL). The mixture was warmed to -30°C and the resulting purple mixture was cooled to -60°C and transferred by cannula into an adjacent flask containing methyl 3-formyl-2-nitrobenzoate (11.6 g) and dry tetrahydrofuran (250 mL). The resulting mixture was allowed to warm to room temperature and was stirred under a nitrogen atmosphere for about 18 hours. The reaction was poured onto a mixture of ice (100 mL) and 3N hydrochloric acid (100 mL) and extracted with ethyl acetate. The extracts were washed with saturated sodium bicarbonate and brine, dried over magnesium sulfate, filtered, and concentrated to a crude oil. Flash column chromatography on silica gel, eluting with dichloromethane gave 9.8 g of the title compound as a yellow oil, n_D 1.5309.

90 MHz NMR ($CDCl_3$) δ: 1.47 (d, 3H, CH_3);
2.58 (s, 1H, OH);
3.92 (s, 3H, OCH_3);
4.93 (m, 1H, CH); and
7.8 (m, 3H, arom.).

IR (neat) 3431, 1735 cm^{-1}.

EXAMPLE 11

Methyl 3-(1-Fluoroethyl)-2-nitrobenzoate

To a solution of diethylamino sulfur trifluoride (18 mL), in dichloromethane (100 mL), stirred at -74°C under a nitrogen atmosphere was added a dichloromethane solution of methyl 3-(1-hydroxyethyl)-2-nitrobenzoate (14.6 g). The reaction was allowed to warm to room temperature and was briefly warmed to 35°C. After a 4 hour reaction period, the reaction was poured onto ice and water (200 mL) and xtract d with dichloromethan . Th combined xtracts w r wash d with a 1:1 mixture of 1N NaOH and saturat d sodium bicarbonat , dried ov r magn sium sulfat , filt r d, and conc ntrat d to give

11.3 g of the title compound as a dark amber oil, n_D 1.5151.

90 MHz NMR ($CDCl_3$) δ: 1.67 (d of d, 3H, CH_3);
3.93 (s, 3H, OCH_3);
5.7 (d of q, 1H, CHF); and
7.9 (m, 3H, arom.).

IR (neat) 1736 cm^{-1}.

EXAMPLE 12

Methyl 3-(1-Fluoroethyl)-2-(phenylmethylthio)benzoate

Following the procedure described in Example 2, methyl 3-(1-fluoroethyl)-2-nitrobenzoate (15 g) was reacted to give 17.55 g of the unpurified title compound as a brown oil.

EXAMPLE 13

2-(Methoxycarbonyl)-6-(1-fluoroethyl)-benzene sulfonyl Chloride

Following the procedure described in Example 2, methyl 3-(1-fluoroethyl)-2-(phenylmethylthio)benzoate (8.8 g) was reacted and chromatographed on silica eluting with 10% ethyl acetate in hexanes to give 1.7 g of the title compound as an orange oil.

90 MHZ NMR ($CDCl_3$) δ: 1.8 (d of d, 3H, CH_3);
4.0 (s, 3H, OCH_3);
6.6 (d of q, 1H, CHF); and
7.8 (m, 3H, arom.).

EXAMPLE 14

Methyl 3-(1-Fluoroethyl)-2-[[[(1,1-dimethyl-ethyl)dimethylsilyl]amino]sulfonyl]benzoate

Following the procedure described in Example 3, 2-(methoxycarbonyl)-6-(1-fluoroethyl)benzene sulfonyl chloride (2.4 g) was reacted and chromatographed on silica luting with 15% thyl ac tat in hexan s t give 1.3 g of the title compount as an orang oil.

90 MHZ NMR ($CDCl_3$) δ: 0.17 (s, 3H, $SiCH_3$);
0.24 (s, 3H, $SiCH_3$);
0.84 (s, 9H, $C(CH_3)_3$);
1.57 (d of d, 3H, CH_3);
3.88 (s, 3H, OCH_3);
5.83 (s, 1H, NH);
6.6 (d of q, 1H, CHF); and
7.6 (m, 3H, arom.).

EXAMPLE 15

Methyl 3-(1-Fluoroethyl)-2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]benzoate

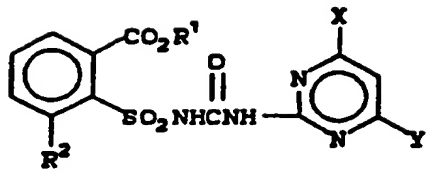
Following the procedure described in Example 4, methyl 3-(1-fluoroethyl)-2-[[[(1,1-dimethylethyl)-dimethylsilyl]amino]sulfonyl]benzoate (0.26 g) and O-phenyl-N-(4,6-dimethoxy-2-pyrimidinyl)carbamate (0.2 g) were reacted to give 0.16 g of the title compound as a pink solid, m.p. 155-158°C (decomposition).

200 MHz NMR (DMSO) δ: 1.64 (d of d, 3H, CH_3);
3.85 (s, 3H, CO_2CH_3);
3.98 (s, 6H, OCH_3);
6.08 (s, 1H, pyrim. H);
7.04 (d of q, 1H, CHF);
7.72 (m, 1H, arom.);
7.96 (m, 2H, arom.);
10.85 (s, 1H, NH); and
12.75 (s, 1H, NH).

IR (mineral oil) 3281, 1738, 1722 cm^{-1}.

By applying the procedures of Equations 1 through 7 and Examples 1 through 15, the compounds in Tables 1 through 4 can be readily prepared by one skilled in the art.

TABLE 1



R^1 is CH_3			R^1 is CH_2CH_3		
R^2	X	Y	R^2	X	Y
CH_2F	CH_3	H	CH_2F	CH_3	H
CH_2F	CH_3	CH_3	CH_2F	CH_3	CH_3
CH_2F	CH_3	C_2H_5	CH_2F	CH_3	C_2H_5
CH_2F	CH_3	OCH_3	CH_2F	CH_3	OCH_3
CH_2F	CH_3	$OCHF_2$	CH_2F	CH_3	$OCHF_2$
CH_2F	OCH_3	H	CH_2F	OCH_3	H
CH_2F	OCH_3	Cl	CH_2F	OCH_3	Cl
CH_2F	OCH_3	C_2H_5	CH_2F	OCH_3	C_2H_5
CH_2F	OCH_3	OCH_3	CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	$OCHF_2$	CH_2F	OCH_3	$OCHF_2$
CHF_2	CH_3	H	CHF_2	CH_3	H
CHF_2	CH_3	CH_3	CHF_2	CH_3	CH_3
CHF_2	CH_3	C_2H_5	CHF_2	CH_3	C_2H_5
CHF_2	CH_3	OCH_3	CHF_2	CH_3	OCH_3
CHF_2	CH_3	OCH_2F	CHF_2	CH_3	OCH_2F
CHF_2	OCH_3	H	CHF_2	OCH_3	H
CHF_2	OCH_3	Cl	CHF_2	OCH_3	Cl
CHF_2	OCH_3	C_2H_5	CHF_2	OCH_3	C_2H_5

R^1 is CH_3

R^2	X	Y
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CH	CH_3	C_2H_5
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CH	OCH_3	C_2H_5
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	H
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

R^1 is $CH_2CH_2CH_3$

R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	C_2H_5
CH_2F	CH_3	OCH_3
CH_2F	CH_3	$OCHF_2$
CH_2F	OCH_3	H

R^1 is CH_2CH_3

R^2	X	Y
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	C_2H_5
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	C_2H_5
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	H
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

R^1 is $CH(CH_3)_2$

R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	C_2H_5
CH_2F	CH_3	OCH_3
CH_2F	CH_3	$OCHF_2$
CH_2F	OCH_3	H

R^1 is $CH_2CH_2CH_3$

R^2	X	Y
CH_2F	OCH_3	Cl
CH_2F	OCH_3	C_2H_5
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	$OCHF_2$
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	C_2H_5
CHF_2	CH_3	OCH_3
CHF_2	CH_3	$OCHF_2$
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl
CHF_2	OCH_3	C_2H_5
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	C_2H_5
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	C_2H_5
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	H
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl

R^1 is $CH(CH_3)_2$

R^2	X	Y
CH_2F	OCH_3	Cl
CH_2F	OCH_3	C_2H_5
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	$OCHF_2$
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	C_2H_5
CHF_2	CH_3	OCH_3
CHF_2	CH_3	OCH_3
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl
CHF_2	OCH_3	C_2H_5
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	C_2H_5
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	C_2H_5
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	H
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl

R^1 is $CH_2CH_2CH_3$

R^2	X	Y
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

R^1 is $CH_2CH{=}CH_2$

R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	C_2H_5
CH_2F	CH_3	OCH_3
CH_2F	CH_3	$OCHF_2$
CH_2F	OCH_3	H
CH_2F	OCH_3	Cl
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	$OCHF_2$
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	C_2H_5
CHF_2	CH_3	OCH_3
CHF_2	CH_3	$OCHF_2$
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	C_2H_5
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl

R^1 is $CH(CH_3)_2$

R^2	X	Y
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

R^1 is CH_2CH_2Cl

R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	OCH_3
CH_2F	CH_3	$OCHF_2$
CH_2F	OCH_3	H
CH_2F	OCH_3	Cl
CH_2F	OCH_3	C_2H_5
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	$OCHF_2$
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	OCH_3
CHF_2	CH_3	$OCHF_2$
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl
CHF_2	OCH_3	C_2H_5
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	C_2H_5

R^1 is $CH_2CH=CH_2$

R^2	X	Y
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	H
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

R^1 is $CH_2C\equiv CH$

R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	C_2H_5
CH_2F	CH_3	OCH_3
CH_2F	CH_3	$OCHF_2$
CH_2F	OCH_3	H
CH_2F	OCH_3	Cl
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	$OCHF_2$
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	C_2H_5
CHF_2	CH_3	OCH_3
CHF_2	CH_3	$OCHF_2$
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl

R^1 is CH_2CH_2Cl

R^2	X	Y
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

R^1 is $CH_2CH_2OCH_3$

R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	OCH_3
CH_2F	CH_3	$OCHF_2$
CH_2F	OCH_3	H
CH_2F	OCH_3	Cl
CH_2F	OCH_3	C_2H_5
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	$OCHF_2$
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	OCH_3
CHF_2	CH_3	$OCHF_2$
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl
CHF_2	OCH_3	C_2H_5

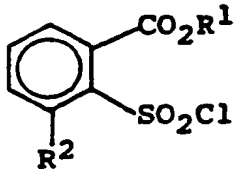
R^1 is $CH_2C{\equiv}CH$

R^2	X	Y
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	C_2H_5
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	H
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

R^1 is $CH_2CH_2OCH_3$

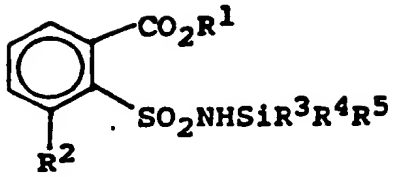
R^2	X	Y
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	C_2H_5
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	H
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

TABLE 2



R^1	R^2
CH_3	CH_2F
CH_3	CHF_2
CH_3	CH_2CN
CH_3	$CHFCH_3$
CH_2CH_3	CH_2F
CH_2CH_3	CHF_2
CH_2CH_3	CH_2CN
CH_2CH_3	$CHFCH_3$
$CH_2CH_2CH_3$	CH_2F
$CH_2CH_2CH_3$	CHF_2
$CH_2CH_2CH_3$	CH_2CN
$CH_2CH_2CH_3$	$CHFCH_3$
$CH(CH_3)_2$	CH_2F
$CH(CH_3)_2$	CHF_2

TABLE 3

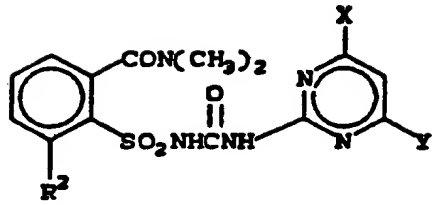


R^1	R^2	R^3	R^4	R^5
CH_3	CH_2F	CH_3	CH_3	CH_3
CH_3	CHF_2	CH_3	CH_3	CH_3
CH_3	CH_2CN	CH_3	CH_3	CH_3
CH_3	$CHFCH_3$	CH_3	CH_3	CH_3
CH_2CH_3	CH_2F	CH_3	CH_3	CH_3
CH_2CH_3	CHF_2	CH_3	CH_3	CH_3
CH_2CH_3	CH_2CN	CH_3	CH_3	CH_3
CH_2CH_3	$CHFCH_3$	CH_3	CH_3	CH_3
CH_3	CH_2F	CH_3	CH_3	$C(CH_3)_3$
CH_3	CHF_2	CH_3	CH_3	$C(CH_3)_3$
CH_3	CH_2CN	CH_3	CH_3	$C(CH_3)_3$
CH_3	$CHFCH_3$	CH_3	CH_3	$C(CH_3)_3$
CH_2CH_3	CH_2F	CH_3	CH_3	$C(CH_3)_3$
CH_2CH_3	CHF_2	CH_3	CH_3	$C(CH_3)_3$
CH_2CH_3	CH_2CN	CH_3	CH_3	$C(CH_3)_3$
CH_2CH_3	$CHFCH_3$	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH_2CH_3$	CH_2F	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH_2CH_3$	CHF_2	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH_2CH_3$	CH_2CN	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH_2CH_3$	$CHFCH_3$	CH_3	CH_3	$C(CH_3)_3$
$CH(CH_3)_2$	CH_2F	CH_3	CH_3	$C(CH_3)_3$
$CH(CH_3)_2$	CHF_2	CH_3	CH_3	$C(CH_3)_3$

R^1	R^2
$CH(CH_3)_2$	CH_2CN
$CH(CH_3)_2$	$CHFCH_3$
$CH_2CH=CH_2$	CH_2F
$CH_2CH=CH_2$	CHF_2
$CH_2CH=CH_2$	CH_2CN
$CH_2CH=CH_2$	$CHFCH_3$
$CH_2C\equiv CH$	CH_2F
$CH_2C\equiv CH$	CHF_2
$CH_2C\equiv CH$	CH_2CN
$CH_2C\equiv CH$	$CHFCH_3$
CH_2CH_2Cl	CH_2F
CH_2CH_2Cl	CHF_2
CH_2CH_2Cl	CH_2CN
CH_2CH_2Cl	$CHFCH_3$
$CH_2CH_2OCH_3$	CH_2F
$CH_2CH_2OCH_3$	CHF_2
$CH_2CH_2OCH_3$	CH_2CN
$CH_2CH_2OCH_3$	$CHFCH_3$

R^1	R^2	R^3	R^4	R^5
$CH(CH_3)_2$	CH_2CN	CH_3	CH_3	$C(CH_3)_3$
$CH(CH_3)_2$	$CHFCH_3$	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH=CH_2$	CH_2F	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH=CH_2$	CHF_2	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH=CH_2$	CH_2CN	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH=CH_2$	$CHFCH_3$	CH_3	CH_3	$C(CH_3)_3$
$CH_2C\equiv CH$	CH_2F	CH_3	CH_3	$C(CH_3)_3$
$CH_2C\equiv CH$	CHF_2	CH_3	CH_3	$C(CH_3)_3$
$CH_2C\equiv CH$	CH_2CN	CH_3	CH_3	$C(CH_3)_3$
$CH_2C\equiv CH$	$CHFCH_3$	CH_3	CH_3	$C(CH_3)_3$
CH_2CH_2Cl	CH_2F	CH_3	CH_3	$C(CH_3)_3$
CH_2CH_2Cl	CHF_2	CH_3	CH_3	$C(CH_3)_3$
CH_2CH_2Cl	CH_2CN	CH_3	CH_3	$C(CH_3)_3$
CH_2CH_2Cl	$CHFCH_3$	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH_2OCH_3$	CH_2F	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH_2OCH_3$	CHF_2	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH_2OCH_3$	CH_2CN	CH_3	CH_3	$C(CH_3)_3$
$CH_2CH_2OCH_3$	$CHFCH_3$	CH_3	CH_3	$C(CH_3)_3$

TABLE 4



R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	C_2H_5
CH_2F	CH_3	OCH_3
CH_2F	CH_3	$OCHF_2$
CH_2F	OCH_3	H
CH_2F	OCH_3	Cl
CH_2F	OCH_3	C_2H_5
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	$OCHF_2$
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	C_2H_5
CHF_2	CH_3	OCH_3
CHF_2	CH_3	$OCHF_2$
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl
CHF_2	OCH_3	C_2H_5
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	$OCHF_2$

R^2	X	Y
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	C_2H_5
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	$OCHF_2$
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	C_2H_5
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	$OCHF_2$
$CHFCH_3$	CH_3	H
$CHFCH_3$	CH_3	CH_3
$CHFCH_3$	CH_3	C_2H_5
$CHFCH_3$	CH_3	OCH_3
$CHFCH_3$	CH_3	$OCHF_2$
$CHFCH_3$	OCH_3	H
$CHFCH_3$	OCH_3	Cl
$CHFCH_3$	OCH_3	OCH_3
$CHFCH_3$	OCH_3	$OCHF_2$

Formulations

Useful formulations of the compounds of Formula I can be prepared in conventional ways. They include dusts, granules, pellets, solutions, suspensions, emulsions, wettable powders, emulsifiable concentrates and the like. Many of these may be applied directly. Sprayable formulations can be extended in suitable media and used at spray volumes of from a few liters to several hundred liters per hectare. High strength compositions are primarily used as intermediates for further formulation. The formulations, broadly, contain about 0.1% to 99% by weight of active ingredient(s) and at least one of (a) about 0.1% to 20% surfactant(s) and (b) about 1% to 99.9% solid or liquid inert diluent(s). More specifically, they will contain these ingredients in the following approximate proportions:

	Weight Percent*		
	Active Ingredient	Diluent(s)	Surfactant(s)
Wettable Powders	20-90	0-74	1-10
Oil Suspensions, Emulsions, Solutions, (including Emulsifiable Concentrates)	3-50	40-95	0-15
Aqueous Suspension	10-50	40-84	1-20
Dusts	1-25	70-99	0-5
Granules and Pellets	0.1-95	5-99.9	0-15
High Strength Compositions	90-99	0-10	0-2

* Active ingredient plus at least one of a Surfactant or a Dilu nt equals 100 weight percent.

Lower r high r levels of activ ingredient can, of course, be present depending on the intended use and the physical properties of the compound. Higher ratios of surfactant to active ingredient are sometimes desirable, and are achieved by incorporation into the formulation or by tank mixing.

Typical solid diluents are described in Watkins, et al., "Handbook of Insecticide Dust Diluents and Carriers", 2nd Ed., Dorland Books, Caldwell, New Jersey, but other solids, either mined or manufactured, may be used. The more absorptive diluents are preferred for wettable powders and the denser ones for dusts. Typical liquid diluents and solvents are described in Marsden, "Solvents Guide," 2nd Ed., Interscience, New York, 1950. Solubility under 0.1% is preferred for suspension concentrates; solution concentrates are preferably stable against phase separation at 0°C. "McCutcheon's Detergents and Emulsifiers Annual", MC Publishing Corp., Ridgewood, New Jersey, as well as Sisely and Wood, "Encyclopedia of Surface Active Agents", Chemical Publishing Co., Inc., New York, 1964, list surfactants and recommended uses. All formulations can contain minor amounts of additives to reduce foaming, caking, corrosion, microbiological growth, etc.

The methods of making such compositions are well known. Solutions are prepared by simply mixing the ingredients. Fine solid compositions are made by blending and, usually, grinding as in a hammer or fluid energy mill. Suspensions are prepared by wet milling (see, for example, Littler, U.S. Patent 3,060,084). Granules and pellets may be made by spraying the active material upon preformed granular carriers or by agglomeration t chniqu s. S J. E. Browning, "Agglom ration", Chemical Engineering, D cemb r 4, 1967, pp. 147ff. and "Perry's Ch mical

Engine r's Handbook", 5th Ed., McGraw-Hill, N w Y rk, 1963, pp. 8-57ff.

For further information regarding the art of formulation, see for example:

H. M. Loux, U.S. Patent 3,235,361, February 15, 1966, Col. 6, line 16 through Col. 7, line 19 and Examples 10 through 41;

R. W. Luckenbaugh, U.S. Patent 3,309,192, March 14, 1967, Col. 5, line 43 through Col. 7, line 62 and Examples 8, 12, 15, 39, 41, 52, 53, 58, 132, 138-140, 162-164, 166, 167 and 169-182;

H. Gysin and E. Knusli, U.S. Patent 2,891,855, June 23, 1959, Col. 3, line 66 through Col. 5, line 17 and Examples 1-4;

G. C. Klingman, "Weed Control as a Science", John Wiley and Sons, Inc., New York, 1961, pp. 81-96; and

J. D. Fryer and S. A. Evans, "Weed Control Handbook", 5th Ed., Blackwell Scientific Publications, Oxford, 1968, pp. 101-103.

In the following examples, all parts are by weight unless otherwise indicated.

Example A

High Strength Concentrate

Methyl 3-(cyanomethyl)-2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]-sulfonyl]benzoate	99%
trimethylnonyl polyethylene glycol ether	1%

The surfactant is sprayed upon the active ingredient in a blender and the mixture sifted through a U. S. S. No. 40 sieve (0.42 mm openings) prior to packaging. The concentrate may be formulated furth r for practical use.

Example B

Wettable Powder

Methyl 2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)-amino]carbonyl]amino]sulfonyl]-3-(cyanomethyl)-benzoate	65%
dodecylphenol polyethylene glycol ether	2%
sodium ligninsulfonate	4%
sodium silicoaluminate	6%
montmorillonite (calcined)	23%

The ingredients are thoroughly blended. The liquid surfactant is added by spraying upon the solid ingredients in the blender. After grinding in a hammer mill to produce particles essentially all below 100 microns, the material is reblended and sifted through a U.S.S. No. 50 sieve (0.3 mm opening) and packaged.

Example C

Aqueous Suspension

Methyl 3-(cyanomethyl)-2-[[[[(4-(difluoro-methoxy)-6-methoxy-2-pyrimidinyl]amino]-carbonyl]amino]sulfonyl]benzoate	50.0%
polyacrylic acid thickener	0.3%
dodecylphenol polyethylene glycol ether	0.5%
disodium phosphate	1%
monosodium phosphate	0.5%
polyvinyl alcohol	1.0%
water	56.7%

The ingredients are blended and ground together in a sand mill to produce particles essentially all under 5 microns in size.

Example D

Oil Suspension

Methyl 3-(difluoromethyl)-2-[[[[(4-m thoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-b nzoate	35%

blend of polyalcohol carboxylic esters and oil soluble petroleum sulfonates 6%
xylene 59%

The ingredients are combined and ground together in a sand mill to produce particles essentially all below 3 microns. The product can be used directly, extended with oils, or emulsified in water.

Example E

Oil Suspension

Methyl 3-(fluoromethyl)-2-[[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate 25%
polyoxyethylene sorbitol hexaoleate 5%
highly aliphatic hydrocarbon oil 70%

The ingredients are ground together in a sand mill until the solid particles have been reduced to under about 5 microns. The resulting thick suspension may be applied directly, but preferably after being extended with oils or emulsified in water.

Example F

Aqueous Suspension

Methyl 2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]-carbonyl]amino]sulfonyl]-3-(fluoromethyl)-benzoate 25%
hydrated attapulgite 3%
crude calcium ligninsulfonate 10%
sodium dihydrogen phosphate 0.5%
water 61.5%

The ingredients are ground together in a ball or roller mill until the solid particles have been reduced to diameters under 10 microns.

Example G

Wettable Powder

Ethyl 2-[[[[(4-chl ro-6-methoxy-2-pyrimidinyl)-amino]carbonyl]amino]sulfonyl]-3-(fluoromethyl)-b nzoat 40.0%

dioctyl sodium sulfosuccinate	1.5%
sodium ligninsulfonate	3%
low viscosity methyl cellulose	1.5%
attapulgite	54%

The ingredients are thoroughly blended, passed through an air mill, to produce an average particle size under 15 microns, reblended, and sifted through a U.S.S. No. 50 sieve (0.3 mm opening) before packaging.

All compounds of the invention may be formulated in the same manner.

Example H

Granule

wettable powder of Example G	15%
gypsum	69%
potassium sulfate	16%

The ingredients are blended in a rotating mixer and water sprayed on to accomplish granulation. When most of the material has reached the desired range of 1.0 to 0.42 cm (U.S.S.#18 to 40 sieves), the granules are removed, dried, and screened. Oversized material is crushed to produce additional material in the desired range. These granules contain % active ingredient.

Example I

Wettable Powder

Methyl 2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]-carbonyl]amino]sulfonyl]-3-(fluoromethyl)-benzoate	50%
sodium alkylnaphthalenesulfonate	2%
low viscosity methyl cellulose	2%
diatomaceous earth	46%

The ingredients are blended, coarsely hammer-milled and th air mill d to produc particl s of active essentially all below 10 microns in diamet r. Th product is rebl nd d b for packaging.

Example J

Extruded Pellet

Methyl 3-(fluoromethyl)-2-[[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate	25%
anhydrous sodium sulfate	10%
crude calcium ligninsulfonate	5%
sodium alkylnaphthalenesulfonate	1%
calcium/magnesium bentonite	59%

The ingredients are blended, hammer-milled and then moistened with about 12% water. The mixture is extruded as cylinders about 3 mm diameter which are cut to produce pellets about 3 mm long. These may be used directly after drying, or the dried pellets may be crushed to pass a U.S.S. No. 20 sieve (0.84 mm openings). The granules held on a U.S.S. No. 40 sieve (0.42 mm openings) may be packaged for use and the fines recycled.

Example K

Wettable Powder

Methyl 3-(difluoromethyl)-2-[[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate	80%
sodium alkylnaphthalenesulfonate	2%
sodium ligninsulfonate	2%
synthetic amorphous silica	3%
kaolinite	13%

The ingredients are blended and then ground in a hammermill to produce particles with an average particle size less than 25 microns in diameter. The material is reblended and sifted through a U.S.S. No. 50 sieve (0.3 mm opening) before being packaged.

Example L

High Strength Concentrate

Methyl 3-(cyanomethyl)-2-[[[[(4-(difluoromethoxy)-6-methoxy-2-pyrimidinyl]amino]carbonyl]amino]-sulfonyl]benzoate	98.5%
silica aerogel	0.5%
synthetic amorphous fine silica	1.0%

The ingredients are blended and ground in a hammer mill to produce a high strength concentrate essentially all passing a U.S.S. No. 50 sieve (0.3 mm openings). This material may then be formulated in a variety of ways.

Example M

Solution

Methyl 3-(cyanomethyl)-2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate, sodium salt	5%
water	95%

The salt is added directly to the water with stirring to produce the solution, which may then be packaged for use.

UTILITY

Test results indicate that compounds of this invention are active postemergence and preemergence herbicides. Many compounds of this invention are useful for the control of selected grass and broadleaf weeds with tolerance to important argonomic crops such as barley (Hordeum vulgare), corn (Zea mays), rice (Oryza sativa), and wheat (Triticum aestivum). Grass weeds controlled include, but are not limited to, barnyardgrass (Echinochloa crus-galli), blackgrass (Alopecurus myosuroides), Bromus spp., f xtail (Setaria spp.), johnsongrass (Sorghum halepense), panicum (Panicum spp.), and wild oat (Avena fatua). Broadl af w eds controll d includ , but ar not

limited to, cocklebur (Xanthium pensylvanicum), jimsonweed (Datura stramonium), lambsquarters (Chenopodium album), morningglory (Ipomoea spp.), pigweed (Amaranthus spp.), Polygonum spp., sicklepod (Cassia obtusifolia), and velvetleaf (Abutilon theophrasti). Many compounds in this invention also control nutsedge (Cyperus spp.). Several compounds from this invention are particularly useful for weed control in cereal crops such as barley and wheat. A select few of these compounds are particularly useful for weed control in corn.

Several compounds in this invention have utility in non-crop areas where selected or complete control of plants or weeds is desired, such as around storage tanks, parking lots, billboards, highways, and railroad structures. These compounds are also useful in fallow areas of crop production such as in wheat and barley and in plantation crops such as palm, banana, citrus, rubber, etc. Alternatively, these compounds may be useful to modify plant growth or as citrus harvest aid abscission agents.

Rates of application for compounds of this invention are determined by a number of factors. These factors include: formulation selected, method of application, amount of vegetation present, growing conditions, etc. In general terms, the subject compounds should be applied at rates from 0.001 to 20 kg/ha with a preferred rate range of from 0.004 to 0.25 kg/ha. One skilled in the art can easily determine rates needed for the desired level of weed control.

Compounds of this invention may be used alone or in combination with other commercial herbicides, insecticid s, or fungicid s. Th following list

exemplifies some of the herbicides suitable for use in mixtures. A combination of compounds from this invention with one or more of the following herbicides may be particularly useful for weed control.

Common Name	Chemical Name
acetochlor	2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide
acifluorfen	5-[2-chloro-4-(trifluoromethyl)-phenoxy]-2-nitrobenzoic acid
alachlor	2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl)acetamide
anilofos	S-4-chloro-N-isopropylcarbaniloyl-methyl-O,O-dimethyl phosphorodithioate
ametryn	N-ethyl-N'-(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
amitrole	1H-1,2,4-triazol-3-amine
AMS	ammonium sulfamate
asulam	methyl [(4-aminophenyl)sulfonyl]-carbamate
atrazine	6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine
barban	4-chloro-2-butynyl 3-chlorocarbamat
benefin	N-butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl)benzenamine
bensulfuron methyl	2-[[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]methyl]benzoic acid, methyl ester
bensulide	O,O-bis(1-methylethyl) S-[2-[(phenylsulfonyl)amino]-thyl]phosphorodithioat
b ntazon	3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-on , 2,2-dioxide

Common Name	Chemical Name
benzofluor	N-[4-(ethylthio)-2-(trifluoromethyl)phenyl]methanesulfonamide
benzoylprop	N-benzoyl-N-(3,4-dichlorophenyl)-DL-alanine
bifenox	methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate
bromacil	5-bromo-6-methyl-3-(1-methylpropyl)-2,4(1H,3H)pyrimidinedione
bromoxynil	3,5-dibromo-4-hydroxybenzonitrile
butachlor	N-(butoxymethyl)-2-chloro-N-(2,6-diethylphenyl)acetamide
buthidazole	3-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-4-hydroxy-1-methyl-2-imidazolidinone
butralin	4-(1,1-dimethylethyl)-N-(1-methylpropyl)-2,6-dinitrobenzenamine
butylate	S-ethyl bis(2-methylpropyl)-carbamothioate
cacodylic acid	dimethyl arsinic oxide
CDAA	2-chloro-N,N-di-2-propenylacetamide
CDEC	2-chloroallyl diethyldithiocarbamate
CGA 142,464	3-(4,6-dimethoxy-1,3,5-triazin-2-yl)-1-[2-(2-methoxyethoxy)-phenylsulfonyl]-urea
chloramben	3-amino-2,5-dichlorobenzoic acid
chlorbromuron	3-(4-bromo-3-chlorophenyl)-1-methoxy-1-methylurea
chlorimuron ethyl	2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]benzoic acid, ethyl st r
chlormethoxynil	2,4-dichlorophenyl 4-nitro-3-m thoxyph nyl eth r

Common Name	Chemical Name
chlornitrofen	2,4,6-trichlorophenyl-4-nitrophenyl ether
chloroxuron	N'-[4-(4-chlorophenoxy)phenyl]-N,N-dimethylurea
chlorpropham	1-methylethyl 3-chlorophenylcarbamate
chlorsulfuron	2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide
chlortoluron	N'-(3-chloro-4-methylphenyl)-N,N-dimethylurea
cinmethylin	exo-1-methyl-4-(1-methylethyl)-2-[(2-methylphenyl)methoxy]-7-oxabicyclo-[2.2.1]heptane
clethodim	(E,E)-(±)-2-[1-[[(3-chloro-2-propenyl)-oxy]imino]propyl]-5-[2-(ethylthio)-propyl]-3-hydroxy-2-cyclohexen-1-one
clomazone	2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone
cloproxydim	(E,E)-2-[1-[[(3-chloro-2-propenyl)oxy)-imino]butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
clopyralid	3,6-dichloro-2-pyridinecarboxylic acid
CMA	calcium salt of MAA
cyanazine	2-[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]amino]-2-methylpropanenitril
cycloate	S-ethyl cyclohexylethylcarbamothioate
cycluron	3-cyclooctyl-1,1-dimethylurea
cyperquat	1-methyl-4-phenylpyridinium
cyprazine	2-chloro-4-(cyclopropylamino)-6-(isopropylamino)-s-triazine

Common Name	Chemical Name
cyprazole	N-[5-(2-chloro-1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]cyclopropanecarboxamide
cypromid	3',4'-dichlorocyclopropanecarboxanilide
dalapon	2,2-dichloropropanoic acid
dazomet	tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione
DCPA	dimethyl 2,3,5,6-tetrachloro-1,4-benzenedicarboxylate
desmediphan	ethyl [3-[[(phenylamino)carbonyl]oxy]-phenyl]carbamate
desmetryn	2-(isopropylamino)-4-(methylamino)-6-(methylthio)-s-triazine
diallate	S-(2,3-dichloro-2-propenyl)bis(1-methylethyl)carbamothioate
dicamba	3,6-dichloro-2-methoxybenzoic acid
dichlobenil	2,6-dichlorobenzonitrile
dichlorprop	(±)-2-(2,4-dichlorophenoxy)propanoic acid
dichlofop	(±)-2-[4-(2,4-dichlorophenoxy)phenoxy]-propanoic acid, methyl ester
diethatyl	N-(chloroacetyl)-N-(2,6-diethylphenyl)-glycine
difenzoquat	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium
dimepiperate	S-1-methyl-1-phenylethylpiperidine-1-carbothioate
dinitramine	N^3,N^3-diethyl-2,4-dinitro-6-(trifluoromethyl)-1,3-benzenediamine
dinoseb	2-(1-methylpropyl)-4,6-dinitrophenol
diphenamid	N,N-dimethyl-α-phenylbenz n acetamide

Common Name	Chemical Name
dipropetryn	6-(ethylthio)-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
diquat	6,7-dihydrodipyrido[1,2-a:2',1'-c]-pyrazinedium ion
diuron	N'-(3,4-dichlorophenyl)-N,N-dimethylurea
DNOC	2-methyl-4,6-dinitrophenol
DPX-M6316	3-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]-2-thiophenecarboxylic acid, methyl ester
DSMA	disodium salt of MAA
dymron	N-(4-methylphenyl)-N'-(1-methyl-1-phenylethyl)urea
endothall	7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
EPTC	S-ethyl dipropylcarbamothioate
esprocarb (SC2957)	S-benzyl-N-ethyl-N-(1,2-dimethyl)-propyl)thiolcarbamate
ethalfluralin	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)-benzenamine
ethofumesate	(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate
fenac	2,3,6-trichlorobenzeneacetic acid
fenoxaprop	(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy]-phenoxy]propanoic acid
fenuron	N,N-dimethyl-N'-phenylurea
fenuron TCA	Salt of fenuron and TCA
flamprop	N-benzoyl-N-(3-chloro-4-fluorophenyl)-DL-alanin

Common Name	Chemical Name
fluazifop	(±)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
fluazifop-P	(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
fluchloralin	N-(2-chloroethyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamine
fluometuron	N,N-dimethyl-N'-[3-(trifluoromethyl)-phenyl]urea
fluorochloridone	3-chloro-4-(chloromethyl)-1-[3-(trifluoromethyl)phenyl]-2-pyrrolidinone
fluorodifen	p-nitrophenyl α,α,α-trifluoro-2-nitro-p-tolyl ether
fluoroglycofen	carboxymethyl 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate
fluridone	1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone
fomesafen	5-[2-chloro-4-(trifluoromethyl)phenoxy]-N-(methylsulfonyl)-2-nitrobenzamide
fosamine	ethyl hydrogen (aminocarbonyl)-phosphate
glyphosate	N-(phosphonomethyl)glycine
haloxyfop	2-[4-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
hexaflurate	potassium hexafluoroarsenate
hexazinone	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione
imazamethabenz	6-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-m-toluic acid, methyl ester and 6-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-p-toluic acid, methyl ester

Common Name	Chemical Name
imazapyr	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid
imazaquin	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-quinolinecarboxylic acid
imazethapyr	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid
ioxynil	4-hydroxy-3,5-diiodobenzonitrile
isopropalin	4-(1-methylethyl)-2,6-dinitro-N,N-dipropylbenzenamine
isoproturon	N-(4-isopropylphenyl)-N',N'-dimethylurea
isouron	N'-[5-(1,1-dimethylethyl)-3-isoxazolyl]-N,N-dimethylurea
isoxaben	N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide
karbutilate	3-[[(dimethylamino)carbonyl]amino]-phenyl-(1,1-dimethylethyl)carbamate
lactofen	(±)-2-ethoxy-1-methyl-2-oxoethyl 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate
lenacil	3-cyclohexyl-6,7-dihydro-1H-cyclopentapyrimidine-2,4(3H,5H)-dione
linuron	N'-(3,4-dichlorophenyl)-N-methoxy-N-methylurea
MAA	methylarsonic acid
MAMA	monoammonium salt of MAA
MCPA	(4-chloro-2-methylphenoxy)acetic acid
MCPB	4-(4-chloro-2-methylphenoxy)butanoic acid

Common Name	Chemical Name
MON 7200	S,S-dimethyl-2-(difluoromethyl)-4-(2-methylpropyl)-6-(trifluoromethyl)-3,5-pyridinedicarbothionate
mecoprop	(±)-2-(4-chloro-2-methylphenoxy)-propanoic acid
mefenacet	2-(2-benzothiazolyloxy-N-methyl-N-phenylacetamide
mefluidide	N-[2,4-dimethyl-5-[[(trifluoromethyl)-sulfonyl]amino]phenyl]acetamide
methal-propalin	N-(2-methyl-2-propenyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamide
methabenz-thiazuron	1,3-dimethyl-3-(2-benzothiazolyl)urea
metham	methylcarbamodithioic acid
methazole	2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione
methoxuron	N'-(3-chloro-4-methoxyphenyl)-N,N-dimethylurea
metolachlor	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide
metribuzin	4-amino-6-(1,1-dimethylethyl)-3-(methyl-thio)-1,2,4-triazin-5(4H)-one
metsulfuron methyl	2-[[[[(4-methoxy-6-methyl-1,3,5-tri-azin-2-yl)amino]carbonyl]-amino]sulfonyl]benzoic acid, methyl ester
MH	1,2-dihydro-3,6-pyridazinedione
molinate	S-ethyl hexahydro-1H-azepine-1-carbo-thioate

Common Name	Chemical Name
monolinuron	3-(p-chlorophenyl)-1-methoxy-1-methyl-urea
monuron	N'-(4-chlorophenyl)-N,N-dimethylurea
monuron TCA	Salt of monuron and TCA
MSMA	monosodium salt of MAA
napropamide	N,N-diethyl-2-(1-naphthalenyloxy)-propanamide
naptalam	2-[(1-naphthalenylamino)carbonyl]-benzoic acid
neburon	1-butyl-3-(3,4-dichlorophenyl)-1-methyl-urea
nitralin	4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline
nitrofen	2,4-dichloro-1-(4-nitrophenoxy)benzene
nitrofluorfen	2-chloro-1-(4-nitrophenoxy)-4-(trifluoromethyl)benzene
norea	N,N-dimethyl-N'-(octahydro-4,7-methano-1H-inden-5-yl)urea 3aα,-4α,5α,7α,7aα-isomer
norflurazon	4-chloro-5-(methylamino)-2-[3-(trifluoromethyl)phenyl]-3(2H)-pyridazinone
oryzalin	4-(dipropylamino)-3,5-dinitrobenzenesulfonamide
oxadiazon	3-[2,4-dichloro-5-(1-methylethoxy)-phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3H)-one
oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene
paraquat	1,1'-dimethyl-4,4'-dipyridinium ion

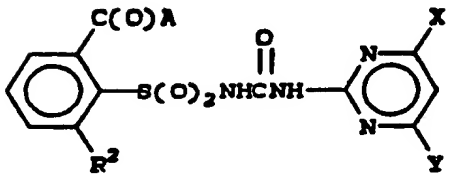
Common Name	Chemical Name
pebulate	S-propyl butylethylcarbamothioate
pendimethalin	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine
perfluidone	1,1,1-trifluoro-N-[2-methyl-4-(phenylsulfonyl)phenyl]methanesulfonamide
phenmedipham	3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate
picloram	4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid
PPG-1013	5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitroacetophenone oxime-O-acetic acid, methyl ester
pretilachlor	α-chloro-2,6-diethyl-N-(2-propoxyethyl)acetanilide
procyazine	2-[[4-chloro-6-(cyclopropylamino)-1,3,5-triazine-2-yl]amino]-2-methylpropanenitrile
profluralin	N-(cyclopropylmethyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamine
prometon	6-methoxy-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
prometryn	N,N'-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
pronamide	3,5-dichloro-N-(1,1-dimethyl-2-propynyl)benzamide
propachlor	2-chloro-N-(1-methylethyl)-N-phenylacetamide
propanil	N-(3,4-dichlorophenyl)propanamide
propazine	6-chloro-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
propham	1-methylethyl phenylcarbamate

Common Name	Chemical Name
prosulfalin	N-[[4-(dipropylamino)-3,5-dinitrophenyl]sulfonyl]-S,S-dimethylsulfilimine
prynachlor	2-chloro-N-(1-methyl-2-propynyl)acetanilide
pyrazolate	4-(2,4-dichlorobenzoyl)-1,3-dimethylpyrazol-5-yl-p-toluenesulphonate
pyrazon	5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone
pyrazosulfuron ethyl	ethyl 5-[3-(4,6-dimethoxypyrimidin-2-yl)ureadosulfonyl]-1-methylpyrazole-4-carboxylate
quinclorac	3,7-dichloro-8-quinoline carboxylic acid
quizalofop ethyl	(±)-2-[4-[(6-chloro-2-quinoxalinyl)-oxy]phenoxy]propanoic acid, ethyl ester
secbumeton	N-ethyl-6-methoxy-N'-(1-methylpropyl)-1,3,5-triazine-2,4-diamine
sethoxydim	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
siduron	N-(2-methylcyclohexyl)-N'-phenylurea
simazine	6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine
SK-233	1-(α,α-dimethylbenzyl)-3-(4-methylphenyl)urea
sulfometuron methyl	2-[[[[(4,6-dimethyl-2-pyrimidinyl)-amino]carbonyl]amino]sulfonyl]-benzoic acid, methyl ester
TCA	trichloroacetic acid
tebuthiuron	N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N'-dim thylurea
terbacil	5-chloro-3-(1,1-dimethyl thyl)-6-methyl-2,4(1H,3H)-pyrimidinedione

Common Name	Chemical Name
terbuchlor	N-(butoxymethyl)-2-chloro-N-[2-(1,1-dimethylethyl)-6-methylphenyl]-acetamide
terbuthyl-azine	2-(tert-butylamino)-4-chloro-6-(ethyl-amino)-s-triazine
terbutol	2,6-di-tert-butyl-p-tolyl methylcar-bamate
terbutryn	N-(1,1-dimethylethyl)-N'-ethyl-6-(methylthio)-1,3,5-triazine-2,4-diamine
thiobencarb	S-[(4-chlorophenyl)methyl] diethylcar-bamothioate
triallate	S-(2,3,3-trichloro-2-propenyl) bis(1-methylethyl)carbamothioate
tribenuron methyl	2-[[[[N-(4-methoxy-6-methyl-1,3,5-triazine-2-yl)-N-methylamino]-carbonyl]amino]sulfonyl]benzoic acid, methyl ester
triclopyr	[(3,5,6-trichloro-2-pyridinyl)-oxy]acetic acid
tridiphane	2-(3,5-dichlorophenyl)-2-(2,2,2-trichloroethyl)oxirane
trifluralin	2,6-dinitro-N,N-dipropyl-4-(tri-fluoromethyl)benzenamine
trimeturon	1-(p-chlorophenyl)-2,3,3-trimethylpseu-dourea
2,4-D	(2,4-dichlorophenoxy)acetic acid
2,4-DB	4-(2,4-dichlorophenoxy)butanoic acid
vernolate	S-propyl dipropylcarbamothioate
xylachlor	2-chloro-N-(2,3-dimethylphenyl)-N-(1-methylethyl)acetamide

Herbicidal properties of the subject compounds were discovered in a series of greenhouse tests. The test procedures and results follow.

COMPOUND TABLE



A = OR^1

CMPD	R^1	R^2	X	Y	m.p.(°C)
1	CH_2CH_3	CH_2CN	CH_3	CH_3	169-175
2	CH_2CH_3	CH_2CN	CH_3	OCH_3	153-156
3	CH_2CH_3	CH_2CN	OCH_3	OCH_3	187-191
4	CH_2CH_3	CH_2CN	OCH_3	Cl	177-184
5	CH_3	CH_2CN	CH_3	CH_3	183-185
6	CH_3	CH_2CN	CH_3	OCH_3	168-170
7	CH_3	CH_2CN	OCH_3	OCH_3	186-194
8	CH_3	CH_2CN	OCH_3	Cl	186-194
9	CH_3	CH_2CN	OCH_3	OCF_2H	165-171
10	CH_3	CH_2CN	OCH_3	H	179-180(d)
11	CH_2CH_3	CH_2F	OCH_3	OCH_3	190-195
12	CH_3	CH_2F	OCH_3	OCH_3	168-170
13	CH_2CH_3	CH_2F	CH_3	OCH_3	177-179
14	CH_2CH_3	CH_2F	OCH_3	Cl	168-172
15	CH_3	CH_2F	OCH_3	Cl	165-172
16	CH_3	CH_2F	CH_3	OCH_3	162-163
17	CH_3	CH_2F	OCH_3	H	166-167(d)

CMPD	R^1	R^2	X	Y	m.p.(°C)
18	$CH(CH_3)_2$	CH_2CN	CH_3	OCH_3	176-177
19	$CH(CH_3)_2$	CH_2CN	OCH_3	OCH_3	196-199
20	$CH(CH_3)_2$	CH_2CN	OCH_3	Cl	196-200
21	$CH(CH_3)_2$	CH_2CN	OCH_3	H	174-175
22	CH_3	CHF_2	CH_3	OCH_3	165-167
23	CH_3	CHF_2	OCH_3	OCH_3	181-185
24	CH_3	CHF_2	OCH_3	H	178-180(d)
25	CH_3	CHF_2	CH_3	CH_3	167-171
26	CH_2CH_3	CHF_2	OCH_3	H	148-155
27	CH_2CH_3	CHF_2	OCH_3	OCH_3	192-194
28	CH_2CH_3	CHF_2	CH_3	OCH_3	162-164
29	$CH(CH_3)_2$	CHF_2	CH_3	OCH_3	174-176
30	$CH(CH_3)_2$	CHF_2	OCH_3	OCH_3	177-180
31	$CH(CH_3)_2$	CHF_2	OCH_3	Cl	186-196
32	CH_2CH_3	CHF_2	CH_3	CH_3	180-192(d)
33	CH_2CH_3	CH_2F	CH_3	CH_3	194-196
34	CH_3	CH_2F	CH_3	CH_3	180-182(d)
35	CH_3	CHF_2	CH_3	CH_3	167-169(d)
36	CH_2CH_3	CHF_2	OCH_3	Cl	173-177
37	CH_3	$CHFCH_3$	OCH_3	OCH_3	155-158
38	CH_3	$CHFCH_3$	CH_3	CH_3	149-153(d)
39	CH_3	$CHFCH_3$	OCH_3	Cl	134-137(d)
40	CH_3	$CHFCH_3$	CH_3	OCH_3	58-64(d)
41	CH_2CH_3	$CHFCH_3$	OCH_3	Cl	153-156(d)
43	CH_3	CH_2CN	CH_3	CH_2CH_3	173-175

CMPD	A	R^2	X	Y	m.p.(°C)
42	$N(CH_3)_2$	$CHFCH_3$	OCH_3	OCH_3	156-158

TEST A

Seeds of barley (Hordeum vulgare), barnyardgrass (Echinochloa crus-galli), cheatgrass (Bromus secalinus), cocklebur (Xanthium pensylvanicum), corn (Zea mays), cotton (Gossypium hirsutum), crabgrass (Digitaria spp.), giant foxtail (Setaria faberi), morningglory (Ipomoea spp.), rice (Oryza sativa), sorghum (Sorghum bicolor), soybean (Glycine max), sugar beet (Beta vulgaris), velvetleaf (Abutilon theophrasti), wheat (Triticum aestivum), and wild oat (Avena fatua) and purple nutsedge (Cyperus rotundus) tubers were planted and treated preemergence with test chemicals dissolved in a non-phytotoxic solvent. At the same time, these crop and weed species were also treated with postemergence applications of test chemicals. Plants ranged in height from two to eighteen cm (two to three leaf stage) for postemergence treatments. Treated plants and controls were maintained in a greenhouse for approximately sixteen days, after which all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table A, are based on a scale of 0 to 10 where 0 is no effect and 10 is complete control. A dash (-) response means no test result.

Tabl A

	COMPOUND																																
Rat (50 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	36
POSTEMERGENCE																																
Barley	9	9	8	3	9	9	9	8	7	0	2	5	9	0	6	9	2	7	9	8	0	9	3	0	9	0	0	8	9	8	6	0
Barnyardgrass	9	9	9	9	10	9	9	9	9	8	9	9	10	9	9	10	7	9	9	8	1	9	9	7	9	7	8	9	9	9	7	7
Cheatgrass	9	10	10	9	9	9	9	9	9	3	9	9	9	10	9	9	8	9	9	8	0	9	9	9	9	8	7	9	9	6	6	9
Cockl bur	10	10	10	10	9	10	10	10	9	9	9	10	10	9	10	10	9	10	10	10	9	10	10	9	10	9	10	9	10	10	10	9
Corn	9	9	9	6	5	9	9	3	6	0	9	9	9	7	7	10	4	9	9	8	2	10	9	0	9	0	5	10	9	8	3	2
Cotton	10	9	9	9	9	10	9	9	9	9	10	9	10	9	9	10	10	9	9	9	9	10	9	9	9	9	9	10	9	9	9	10
Crabgrass	-	9	8	5	9	10	6	8	7	2	9	8	6	8	6	9	0	6	3	1	0	3	1	4	9	0	0	9	4	5	4	0
Giant f xtail	9	9	9	8	9	10	9	9	6	5	5	9	8	3	8	9	3	9	9	3	0	10	6	4	9	0	2	8	7	8	6	1
M rningglory	9	10	10	10	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	10	9	10	10	9	10	10	10	9
Nutsedge	9	10	10	10	-	10	10	10	10	6	10	-	10	10	10	10	9	9	10	-	-	10	10	9	10	9	8	9	9	10	10	0
Ric	9	9	9	9	9	9	9	9	9	4	9	9	8	7	9	9	4	9	9	9	5	9	9	8	9	4	3	8	9	8	7	5
S rghum	9	9	9	9	9	9	10	9	9	9	9	9	9	8	9	9	9	9	9	9	8	9	-	9	-	6	4	9	9	6	7	6
S yb an	9	9	9	7	9	9	9	9	9	9	9	9	9	6	9	9	9	9	9	7	9	9	9	9	9	9	9	9	9	9	7	9
Sugar b et	9	9	10	10	9	10	9	9	10	10	10	9	10	9	9	9	9	10	10	9	9	10	10	10	9	10	10	10	10	9	9	10
V lvetleaf	10	10	10	9	10	10	9	10	10	9	9	10	10	9	9	10	9	9	9	-	-	-	9	9	10	9	9	-	9	9	10	9
Wheat	9	9	9	7	9	9	9	9	7	2	7	5	9	2	8	9	0	9	9	3	0	9	3	0	9	0	0	8	6	2	0	0
Wild at	9	9	7	5	9	9	7	8	6	4	3	3	8	4	6	9	2	8	5	3	0	7	4	2	9	0	0	6	5	0	3	3

Table A

	COMPOUND																																	
Rate (50 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	36
PREEMERGENCE																																
Barley	9	8	9	6	9	9	9	9	3	0	3	0	8	2	4	9	0	8	6	2	0	7	3	2	9	1	3	7	7	0	1	2
Barnyardgrass	9	9	9	8	9	9	9	9	6	0	5	9	9	0	9	9	4	9	9	9	1	9	7	2	9	0	2	8	8	7	4	5
Ch atgrass	9	9	9	7	9	9	9	7	4	2	8	8	8	6	8	9	4	8	8	8	6	8	7	5	8	5	6	7	9	7	7	5
Cocklebur	9	9	9	8	9	8	9	5	7	1	9	-	9	7	7	9	4	9	9	6	2	9	8	6	9	6	9	8	8	8	6	8
Corn	9	9	9	7	8	9	8	1	0	0	0	3	9	0	2	9	0	9	8	8	0	8	2	0	9	3	5	9	7	1	0	3
Cott n	9	9	9	3	9	9	9	7	0	2	3	2	8	1	7	9	6	7	8	7	0	4	8	4	9	8	1	7	6	4	-	5
Crabgrass	8	9	8	6	10	9	9	9	7	0	4	4	9	2	9	9	2	6	4	2	0	7	4	6	10	0	5	7	6	3	0	2
Giant foxtail	9	9	8	6	9	9	9	8	3	2	5	5	7	0	6	9	3	8	6	7	0	9	5	2	9	0	2	6	7	4	2	2
Morningglory	9	8	9	9	9	9	9	9	9	2	0	8	2	8	9	9	7	9	9	6	2	9	9	4	9	3	9	7	9	6	9	9
Nutsedge	10	8	8	8	10	10	10	9	9	0	0	10	9	0	8	9	0	8	10	10	0	8	0	4	9	10	0	-	6	10	10	0
Ric	9	9	9	9	10	9	9	9	8	0	5	8	9	7	8	9	7	10	9	9	5	9	8	8	10	6	5	9	8	5	4	4
Sorghum	10	9	9	9	10	9	9	9	9	6	3	4	9	7	9	9	8	9	9	9	7	9	7	8	10	4	2	9	9	2	4	6
Soybean	9	9	9	5	9	9	9	8	4	3	1	4	9	0	1	8	4	9	9	3	1	7	7	7	8	6	7	8	8	3	5	5
Sugar beet	9	9	9	9	9	9	9	9	9	8	6	8	9	8	9	9	7	9	9	9	9	9	9	8	9	9	9	9	9	8	9	8
Velvetleaf	9	9	8	8	9	9	9	8	9	3	7	7	9	6	9	9	9	9	5	6	5	8	7	8	9	7	7	9	9	8	5	9
Wheat	9	8	9	7	9	9	9	9	8	0	0	0	9	0	2	9	0	9	8	8	0	8	0	0	9	0	0	9	6	0	0	0
Wild at	8	8	5	5	8	8	7	6	0	2	0	0	8	0	3	8	0	8	3	3	2	6	2	0	8	0	0	4	5	0	0	0

Tabl A

	COMPOUND																														
Rate (10 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	36
POSTEMERGENCE																																
Barley	9	8	5	2	9	9	9	3	2	0	0	0	8	0	0	9	0	8	5	2	0	9	2	0	9	0	0	7	7	6	2	0
Barnyardgrass	9	9	9	8	9	9	9	9	8	6	9	9	9	7	9	10	6	9	9	3	0	9	7	6	8	2	8	9	8	9	4	5
Cheatgrass	9	9	9	6	9	9	9	9	2	3	9	9	9	8	9	9	6	8	6	5	0	9	9	7	10	8	8	4	6	6	4	5
Cocklebur	9	9	10	9	9	9	9	10	9	9	10	10	9	10	9	10	9	9	9	10	9	10	10	9	10	10	10	10	10	9	10	10
C rn	7	9	9	3	0	9	9	0	2	0	9	9	9	2	3	9	2	9	9	6	0	9	8	0	9	0	2	9	9	5	0	0
Cotton	9	9	9	9	9	9	9	9	9	9	9	9	9	9	10	10	9	9	9	9	9	10	9	9	9	9	10	10	9	9	9	9
Crabgrass	0	2	2	0	6	5	2	2	0	0	4	9	8	2	2	4	0	0	1	0	0	2	0	0	9	0	0	9	2	2	0	0
Giant f xtail	8	7	5	2	9	9	9	4	2	0	3	7	6	0	6	9	2	6	4	0	0	8	3	0	9	0	1	5	5	7	2	0
Morningglory	9	9	10	10	6	10	10	10	9	9	10	10	9	10	10	10	9	10	9	9	8	10	10	10	10	10	10	10	10	9	9	10
Nutsedge	9	9	-	9	9	-	-	-	-	0	9	10	10	10	10	10	9	9	8	9	0	10	10	9	10	10	9	9	8	10	9	0
Rice	9	9	8	8	9	9	9	9	7	2	3	9	9	1	7	9	3	9	9	9	2	8	9	7	9	0	2	6	5	4	4	0
S rghum	9	9	9	8	9	9	9	9	9	9	9	9	9	5	9	9	8	9	9	8	5	9	7	6	9	0	5	7	6	6	4	4
S yb an	9	9	9	5	9	9	9	8	8	-	9	9	9	5	5	9	8	9	9	3	2	8	9	9	10	9	9	9	8	9	4	8
Sugar be t	9	9	9	9	9	8	9	9	9	9	10	9	10	10	9	9	9	9	9	9	8	10	10	10	10	10	10	10	9	9	8	10
Velv tleaf	9	10	9	8	9	9	10	9	9	8	9	10	9	9	9	9	8	9	9	-	8	-	9	9	10	9	9	9	7	9	9	9
Wheat	9	9	6	2	9	9	9	2	0	0	0	0	3	0	2	9	0	9	8	0	0	5	0	0	9	0	0	0	3	0	0	0
Wild at	9	8	4	2	9	8	5	3	3	2	0	2	2	0	4	8	0	7	0	0	0	4	2	0	9	0	0	2	0	0	3	0

Table A

	COMPOUND																															
Rate (10 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	36
PREEMERGENCE																																
Barl y	8	8	7	2	9	9	8	7	0	0	0	0	6	0	0	8	0	6	0	0	0	5	3	0	8	0	0	3	2	0	0	0
Barnyardgrass	7	9	7	7	9	9	9	8	0	0	0	4	9	0	7	9	3	9	5	3	0	7	5	0	8	0	0	0	3	2	0	0
Cheatgrass	8	8	8	7	9	9	8	7	2	0	2	5	7	0	6	8	2	7	7	5	0	5	2	2	8	2	0	3	7	2	2	0
C cklebur	7	7	7	5	9	8	8	5	0	0	-	3	9	0	7	4	3	8	5	7	2	7	5	-	8	2	3	2	6	3	-	1
Corn	9	9	8	3	6	6	8	0	0	0	0	2	7	0	0	7	2	8	5	6	0	3	0	0	9	0	0	0	2	0	0	0
Cotton	7	4	2	3	8	8	9	2	0	0	0	0	3	0	2	8	4	7	2	3	0	2	0	0	8	1	0	1	5	2	0	0
Crabgrass	7	7	4	2	9	9	7	9	0	0	0	4	2	0	7	9	0	2	2	0	0	5	4	2	8	0	0	2	0	0	0	0
Giant foxtail	9	8	7	1	9	9	9	2	3	0	0	2	3	0	2	9	3	7	2	3	0	6	0	0	7	0	0	2	2	2	0	0
Morninggl ry	3	4	9	8	7	9	9	8	2	0	0	4	3	0	4	7	6	7	0	0	0	9	7	2	8	0	3	2	2	1	1	9
Nutsedg	9	8	5	3	10	9	10	0	7	0	0	0	2	0	10	7	-	7	5	0	0	0	0	0	0	0	0	0	10	6	4	0
Rice	-	9	9	9	9	9	8	9	5	0	0	7	8	0	7	9	3	9	8	7	0	6	0	3	9	2	0	4	4	0	0	0
Sorghum	9	10	9	9	10	9	9	9	3	2	0	0	8	0	7	9	3	9	9	8	2	7	6	3	9	3	0	3	5	2	2	0
Soybean	8	9	6	5	9	8	6	3	1	0	1	3	7	0	0	7	2	7	1	1	0	4	3	5	9	2	2	3	4	2	0	0
Sugar beet	9	9	9	9	9	9	9	7	8	4	2	6	7	0	8	9	4	8	5	5	2	9	6	3	8	9	4	9	8	4	7	8
Velvetl af	9	7	4	5	9	8	8	7	2	2	0	5	9	0	7	9	6	8	2	7	2	3	3	4	3	1	5	2	8	3	2	0
Wheat	9	9	8	5	8	9	8	7	0	0	0	0	5	0	0	9	0	8	4	2	0	3	0	0	6	0	0	0	0	0	0	0
Wild at	8	6	4	0	8	8	3	0	0	0	0	0	5	0	0	6	0	7	0	0	0	2	0	0	3	0	0	0	2	0	0	0

TEST B

Seeds of barley (Hordeum vulgare), barnyardgrass (Echinochloa crus-galli), blackgrass (Alopecurus myosuroides), cheatgrass (Bromus secalinus), chickweed (Stellaria media), cocklebur (Xanthium pensylvanicum), corn (Zea mays), cotton (Gossypium hirsutum), crabgrass (Digitaria spp.), bedstraw (Galium aparine), giant foxtail (Setaria faberii), lambsquarters (Chenopodium album), morningglory (Ipomoea hederacea), rape (Brassica napus), rice (Oryza sativa), sorghum (Sorghum bicolor), soybean (Glycine max), sugar beet (Beta vulgaris), velvetleaf (Abutilon theophrasti), wheat (Triticum aestivum), wild buckwheat (Polygonum convolvulus), and wild oat (Avena fatua) and purple nutsedge (Cyperus rotundus) tubers were planted and treated preemergence with test chemicals dissolved in a non-phytotoxic solvent. At the same time, these crop and weed species were also treated with postemergence applications of test chemicals. Plants ranged in height from two to eighteen cm (one to four leaf stage) for postemergence treatments. Treated plants and controls were maintained in a greenhouse for twelve to sixteen days, after which all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table B, are based on a scale of 0 to 10 where 0 is no effect and 10 is complete control. A dash (-) response means no test result.

Table B

	COMPOUND
Rate (200 g/ha)	43
POSTEMERGENCE	
Barley	8
Barnyardgrass	10
Bedstraw	9
Blackgrass	10
Cheatgrass	9
Chickweed	10
Corn	9
Cotton	9
Crabgrass	6
Giant foxtail	9
Lambsquarters	9
Morningglory	10
Nutsedge	10
Rape	10
Rice	9
Sorghum	9
Soybean	9
Sugar beet	9
Velvetleaf	9
Wheat	9
Wild buckwheat	9
Wild oat	8

Tabl B

	COMPOUND
Rate (200 g/ha)	43
PREEMERGENCE	
Barley	8
Barnyardgrass	9
Bedstraw	9
Blackgrass	9
Cheatgrass	8
Chickweed	9
Corn	9
Cotton	8
Crabgrass	9
Giant foxtail	9
Lambsquarters	9
Morningglory	9
Nutsedge	10
Rape	9
Rice	10
Sorghum	9
Soybean	9
Sugar beet	9
Velvetleaf	9
Wheat	9
Wild buckwheat	9
Wild oat	8

Tabl B

	COMPOUND										
Rate (50 g/ha)	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley	9	9	10	10	7	9	5	9	5	9	7
Barnyardgrass	9	10	10	9	9	9	10	9	9	10	9
Bedstraw	10	9	9	10	9	10	10	10	10	10	7
Blackgrass	9	10	10	9	9	9	9	9	8	9	9
Cheatgrass	9	9	10	9	9	9	9	9	9	9	8
Chickweed	10	-	-	10	10	10	9	10	9	10	9
Cocklebur	10	10	10	10	10	10	10	10	-	10	-
Corn	10	10	9	10	10	10	9	9	9	10	7
Cotton	9	9	10	10	9	10	10	9	10	9	9
Crabgrass	9	-	-	9	4	10	5	4	0	5	4
Giant foxtail	9	9	10	9	9	10	9	9	6	9	9
Lambsquarters	10	10	10	10	10	10	9	9	10	10	9
Morningglory	9	9	9	9	10	10	9	10	10	10	10
Nutsedge	10	10	10	9	10	10	10	10	9	-	10
Rape	10	9	9	9	9	9	9	10	10	9	9
Rice	9	9	10	9	9	10	9	9	8	9	9
Sorghum	9	9	10	9	9	10	9	9	8	10	9
Soybean	9	9	9	9	9	9	9	9	9	9	9
Sugar beet	10	9	9	10	9	9	9	10	10	10	9
Velvetleaf	9	10	10	10	10	10	10	9	9	10	9
Wheat	9	9	9	9	8	9	4	9	5	9	8
Wild buckwheat	10	10	10	10	10	10	10	10	10	9	7
Wild oat	9	9	10	9	7	9	8	9	7	6	5

Table B

	COMPOUND										
Rate (50 g/ha)	32	33	34	35	37	38	39	40	41	42	43
PREEMERGENCE											
Barley	9	9	9	9	2	9	1	2	2	9	5
Barnyardgrass	9	9	9	9	7	9	5	7	5	9	9
Bedstraw	7	8	8	7	7	9	9	8	8	9	8
Blackgrass	9	9	9	8	5	9	4	9	8	9	8
Cheatgrass	9	9	10	9	8	9	8	9	8	9	8
Chickweed	10	-	-	10	9	10	10	-	9	10	8
Cocklebur	9	9	9	-	6	8	9	-	-	9	-
Corn	9	9	9	9	7	9	3	8	6	9	7
Cotton	9	9	9	9	3	9	8	8	0	8	5
Crabgrass	7	9	9	8	5	9	2	6	2	7	7
Giant foxtail	7	6	8	9	5	8	6	7	2	9	8
Lambsquarters	10	10	-	10	9	9	10	10	9	10	9
Morningglory	8	6	9	10	9	9	9	9	9	9	9
Nutsedge	9	10	9	10	7	10	9	0	9	10	10
Rape	10	9	9	9	9	10	9	9	9	9	8
Rice	10	9	10	9	8	10	8	7	8	9	9
Sorghum	9	9	9	9	9	10	8	7	0	9	9
Soybean	9	9	9	9	9	9	6	8	2	9	7
Sugar beet	9	8	8	9	9	9	9	9	9	9	9
Velvetleaf	9	9	9	9	8	9	7	9	7	9	8
Wheat	9	9	9	9	0	9	2	7	2	9	9
Wild buckwheat	8	8	8	8	5	6	1	5	5	9	8
Wild oat	9	9	9	9	1	9	1	2	7	2	7

Table B

	COMPOUND									
Rate (10 g/ha)	32	33	34	35	37	38	39	40	41	42
POSTEMERGENCE										
Barley	9	9	9	9	4	9	4	9	0	9
Barnyardgrass	8	10	10	9	9	9	9	9	8	10
Bedstraw	6	7	7	8	10	9	10	10	9	9
Blackgrass	9	9	9	8	8	9	7	9	9	10
Cheatgrass	9	9	9	9	9	9	7	9	5	9
Chickweed	10	9	-	10	10	9	10	10	8	9
Cocklebur	10	9	10	10	10	10	10	9	-	-
Corn	9	9	9	9	9	10	1	9	4	9
Cotton	9	9	9	9	9	9	9	9	9	9
Crabgrass	-	-	-	7	-	9	2	3	0	0
Giant foxtail	8	7	10	9	5	9	5	8	3	8
Lambsquarters	9	9	10	10	10	9	10	9	9	9
Morningglory	6	3	8	9	10	10	9	9	10	10
Nutsedge	9	10	10	9	10	10	10	9	9	8
Rape	10	9	9	9	9	9	9	10	10	9
Rice	9	9	10	9	7	9	3	8	2	9
Sorghum	9	9	10	9	9	10	8	9	2	9
Soybean	9	9	9	9	9	9	9	9	8	9
Sugar beet	10	5	9	9	10	9	9	9	10	9
Velvetleaf	9	9	10	9	10	9	9	9	9	9
Wheat	9	9	9	9	3	9	2	7	1	9
Wild buckwheat	-	7	10	9	9	9	10	9	9	7
Wild oat	9	9	10	9	3	9	2	5	2	2

Tabl B

	COMPOUND									
Rate (10 g/ha)	32	33	34	35	37	38	39	40	41	42
PREEMERGENCE										
Barley	7	8	8	2	0	3	0	1	0	3
Barnyardgrass	3	4	9	7	3	7	0	3	2	7
Bedstraw	7	5	8	0	3	5	0	3	1	3
Blackgrass	8	8	9	7	2	7	3	6	0	7
Cheatgrass	9	9	9	9	7	9	7	8	7	8
Chickweed	10	-	-	-	10	9	10	-	8	10
Cocklebur	7	4	7	-	0	8	7	0	-	6
Corn	9	9	9	8	1	7	0	2	0	0
Cotton	5	9	8	9	0	6	8	6	0	3
Crabgrass	2	6	6	3	1	9	0	2	0	0
Giant foxtail	3	6	2	5	0	7	0	5	0	4
Lambsquarters	9	-	9	9	10	9	10	10	6	9
Morningglory	4	4	5	9	3	9	6	3	0	6
Nutsedge	5	9	9	9	0	10	7	3	0	0
Rape	9	9	9	9	8	9	2	2	3	9
Rice	9	9	9	9	4	9	6	2	3	6
Sorghum	1	9	8	9	0	8	0	1	0	3
Soybean	7	6	6	7	3	6	2	2	0	6
Sugar beet	8	7	7	8	8	8	9	7	8	8
Velvetleaf	7	2	9	7	7	8	5	5	2	3
Wheat	7	8	9	7	0	6	0	2	0	6
Wild buckwheat	5	6	8	3	2	3	0	0	2	2
Wild oat	5	8	9	6	0	4	0	3	4	0

TEST C

Seeds of barley (Hordeum vulgare), barnyardgrass (Echinochloa crus-galli), blackgrass (Alopecurus myosuroides), chickweed (Stellaria media), cocklebur (Xanthium pensylvanicum), corn (Zea mays), cotton (Gossypium hirsutum), crabgrass (Digitaria spp.), downy brome (Bromus tectorum), giant foxtail (Setaria faberi), green foxtail (Setaria viridis), jimsonweed (Datura stramonium), johnsongrass (Sorghum halepense), lambsquarters (Chenopodium album), morningglory (Ipomoea spp.), rape (Brassica napus), rice (Oryza sativa), sicklepod (Cassia obtusifolia), soybean (Glycine max), sugar beet (Beta vulgaris), teaweed (Sida spinosa), velvetleaf (Abutilon theophrasti), wheat (Triticum aestivum), wild buckwheat (Polygonum convolvulus), and wild oat (Avena fatua) and purple nutsedge (Cyperus rotundus) tubers were planted and treated preemergence with test chemicals dissolved in a non-phytotoxic solvent. At the same time, these crop and weed species were also treated with postemergence applications of test chemicals. Plants ranged in height from two to eighteen cm (two to three leaf stage) for postemergence treatments. Treated plants and controls were maintained in a greenhouse for approximately 24 days, after which all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table C, are reported on a 0 to 10 scale where 0 is no effect and 10 is complete control. A dash (-) response means no test result.

Table C

	COMPOUND	
Rate (250 g/ha)	4	10
POSTEMERGENCE		
Barley	7	-
Blackgrass	9	5
Chickweed	10	10
Cocklebur	10	10
Corn	8	2
Cotton	10	9
Crabgrass	7	3
Downy brome	7	5
Giant foxtail	7	7
Green foxtail	8	7
Jimsonweed	10	10
Johnsongrass	9	10
Lambsquarters	10	10
Morningglory	10	10
Nutsedge	10	4
Rape	10	10
Rice Dry Seed	10	9
Sicklepod	10	8
Soybean	9	10
Sugar beet	10	10
Teaweed	9	7
Velvetleaf	10	10
Wheat	8	3
Wild buckwheat	9	10
Wild oat	9	2
Barnyardgrass	10	9

Table C

	COMPOUND	
Rate (250 g/ha)	4	10
PREEMERGENCE		
Barley	7	0
Blackgrass	9	-
Chickweed	7	7
Cocklebur	10	6
Corn	9	0
Cotton	7	4
Crabgrass	9	10
Downy brome	9	6
Giant foxtail	8	7
Green foxtail	9	7
Jimsonweed	9	8
Johnsongrass	9	8
Lambsquarters	10	-
Morningglory	9	8
Nutsedge	9	0
Rape	10	9
Rice Dry Seed	10	9
Sicklepod	9	5
Soybean	8	3
Sugar beet	9	9
Teaweed	8	6
Velvetleaf	9	10
Wheat	9	0
Wild buckwheat	9	7
Wild oat	8	-
Barnyardgrass	10	6

Tabl C

	COMPOUND																													
Rate (62 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36
POSTEMERGENCE																														
Barley	9	9	8	6	10	10	9	8	-	-	3	4	7	4	9	2	6	4	0	10	4	5	10	5	4	9	8	2	3	5
Blackgrass	9	10	9	9	10	10	10	9	10	5	10	7	9	6	8	4	9	8	7	10	6	5	10	6	7	10	10	9	5	3
Chickweed	10	10	10	9	10	10	10	10	10	9	10	9	10	8	10	10	8	10	0	10	10	10	10	6	10	10	10	10	6	9
Cockl bur	10	10	10	9	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Corn	9	10	10	7	9	10	10	2	6	0	10	10	10	6	10	0	10	10	7	10	10	4	10	0	7	10	10	10	6	7
C tt n	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Crabgrass	8	5	8	5	9	7	7	8	5	2	7	9	6	3	9	4	6	4	3	10	-	6	10	0	4	7	5	0	0	6
D wny brome	9	9	8	7	10	10	9	7	5	4	3	2	7	6	9	3	6	5	0	10	4	0	10	0	0	8	9	0	3	0
Giant foxtail	10	9	10	7	10	10	10	8	5	5	4	7	7	7	10	2	8	6	3	10	6	5	10	0	0	5	0	0	4	2
Gr en foxtail	9	8	8	7	10	10	10	8	2	6	5	7	7	6	10	4	7	6	3	10	7	7	10	0	2	8	4	0	4	2
Jims nwe d	9	10	9	9	9	10	10	10	9	9	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10
Johnsongrass	10	10	10	7	10	10	10	10	8	10	7	9	10	9	10	6	7	9	7	10	6	8	10	7	2	10	5	4	7	5
Lambsquarters	10	10	10	8	10	10	10	10	10	10	10	10	10	10	-	8	-	-	-	10	10	10	-	-	-	-	-	-	-	10
Morningglory	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Nutsedge	10	10	10	10	10	10	10	10	10	4	10	10	10	10	10	10	10	10	10	10	10	10	10	5	10	10	10	6	10	10
Rap	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Rice Dry Seed	10	10	10	9	10	10	10	10	9	6	5	7	6	7	9	6	8	7	7	10	10	9	10	6	4	8	9	5	5	5
Sicklepod	10	10	10	8	10	10	10	9	10	6	10	10	9	10	10	9	10	10	8	10	10	10	10	6	10	10	10	10	7	10
Soybean	10	10	10	9	9	9	10	10	10	10	10	10	10	9	9	9	10	10	9	10	10	10	10	10	10	10	10	10	10	10
Sugar beet	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	10	10	10	10	10	10	10	10	10	10	10
T awe d	9	9	8	8	10	9	8	9	6	5	7	9	9	9	10	8	9	7	8	10	10	10	10	9	6	10	7	8	8	10
Velvetl af	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	9
Wheat	9	8	9	5	10	10	9	9	6	0	1	2	8	4	9	2	8	6	3	10	5	0	10	0	3	7	6	0	0	0
Wild buckwheat	10	10	10	9	10	10	10	10	10	9	10	10	10	10	9	9	10	10	8	10	10	10	10	10	9	10	10	10	9	9
Wild at	10	9	9	5	10	10	9	9	0	0	1	0	6	8	8	0	6	5	3	8	0	0	10	3	4	5	6	0	0	4
Barnyardgrass	10	10	10	9	10	10	10	10	10	8	8	10	10	10	10	7	8	8	7	10	10	10	10	0	6	10	9	8	4	8

Table C

	COMPOUND																													
Rat (62 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36
PREEMERGENCE																														
Barl y	9	9	7	4	10	10	9	4	3	0	4	0	8	3	7	3	8	7	5	7	6	0	8	2	1	7	7	6	4	3
Blackgrass	8	9	10	7	10	10	10	8	-	-	4	4	9	5	8	4	10	10	8	10	0	5	7	7	6	8	7	5	5	8
Chickweed	6	8	9	7	9	9	10	5	10	7	9	9	9	7	9	8	9	8	5	9	9	8	7	6	9	10	9	8	7	8
C cklebur	9	10	9	8	9	9	9	8	3	0	8	9	9	5	9	5	10	10	9	9	10	7	9	10	7	10	10	10	8	9
Corn	9	9	9	4	7	10	9	3	0	0	6	3	10	6	9	0	9	7	10	10	6	0	10	0	-	9	7	3	2	5
Cotton	9	8	8	6	9	8	8	9	6	2	7	9	8	8	8	4	6	5	3	9	8	7	9	9	7	9	6	4	4	8
Crabgrass	9	9	8	8	10	10	9	8	10	10	8	9	7	8	10	5	8	9	5	9	7	0	8	5	10	8	8	8	8	8
Downy brome	9	9	9	5	9	10	10	9	6	3	3	4	10	4	8	3	10	8	3	10	5	3	10	4	4	8	9	3	4	5
Giant f xtail	8	10	9	7	10	10	9	8	7	6	3	4	7	3	8	3	9	8	7	10	3	3	10	2	6	7	6	4	5	4
Green f xtail	9	10	9	9	9	10	10	10	7	6	3	6	8	4	8	4	9	8	7	10	7	7	10	4	5	7	8	4	6	5
Jims nwe d	9	9	9	7	10	9	9	9	6	4	8	9	9	8	9	4	9	9	8	10	9	9	9	7	9	10	9	8	9	10
J hns ngrass	9	9	9	8	9	9	9	9	7	7	7	6	9	8	9	6	9	9	8	10	6	7	10	8	4	9	8	6	7	6
Lambsquarters	10	10	10	9	10	10	10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Morningglory	10	10	9	9	9	9	9	10	9	6	9	9	8	8	8	6	9	8	10	9	9	7	9	10	10	10	10	9	9	10
Nutsedge	10	10	10	8	10	10	8	10	0	0	10	10	8	9	9	10	9	9	8	10	3	10	10	8	10	9	6	7	10	10
Rape	10	10	10	10	10	10	10	10	9	8	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Rice Dry Seed	10	10	10	9	10	10	10	9	10	4	5	6	8	8	10	6	10	9	9	9	10	8	10	7	2	7	6	4	4	5
Sickl pod	9	10	9	4	8	10	9	5	6	0	9	10	9	7	9	5	10	8	8	10	10	10	10	7	10	10	9	8	7	7
S ybean	9	10	10	8	10	9	9	9	4	0	9	7	9	7	9	0	8	7	6	10	9	7	9	5	10	10	8	7	3	7
Sugar be t	9	10	9	9	9	10	10	9	10	8	10	10	10	8	9	8	9	9	8	10	10	9	9	10	10	10	10	9	9	10
Teawe d	8	8	6	7	9	9	9	8	3	4	7	8	9	9	9	7	9	7	8	10	7	7	9	9	8	10	9	9	5	10
V lvetl af	9	10	10	7	10	10	10	9	10	3	9	9	10	9	9	9	10	10	9	10	10	9	9	9	10	10	10	10	9	10
Wheat	9	9	9	7	9	9	9	9	4	0	0	0	8	0	8	0	7	7	4	7	3	0	7	0	0	6	7	0	3	3
Wild buckwh at	9	9	9	8	9	9	9	9	7	6	7	7	9	7	9	6	9	7	7	9	9	8	9	10	8	9	8	7	7	8
Wild at	9	9	8	4	9	9	8	6	5	0	0	3	7	3	6	0	8	7	6	5	3	0	7	2	2	8	7	0	3	3
Barnyardgrass	10	10	10	8	10	10	10	9	9	3	9	8	10	10	10	6	10	8	6	10	9	8	10	6	6	10	8	6	4	7

Tabl C

COMPOUND

Rat (16 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36
POSTEMERGENCE																														
Barley	8	8	7	4	9	9	7	4	-	-	0	3	6	2	8	0	4	0	0	9	3	3	10	3	0	6	5	0	0	0
Blackgrass	9	9	9	8	9	10	10	8	9	0	5	5	8	4	7	2	8	6	5	9	5	4	8	4	3	10	9	5	2	3
Chickwe d	10	10	10	7	9	10	10	8	9	8	8	9	9	8	10	7	7	7	0	10	10	7	10	5	9	9	10	10	0	9
Cocklebur	9	9	10	8	10	9	10	9	10	9	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	-	10	-	9	10
C rn	8	9	9	4	3	9	9	0	4	0	10	10	9	2	10	0	8	10	5	10	9	2	10	0	4	10	9	7	1	4
C tton	9	9	10	9	10	9	10	9	10	10	8	10	10	9	9	7	9	10	8	10	10	9	10	6	10	10	9	7	6	10
Crabgrass	7	5	5	3	7	7	3	5	4	0	6	6	5	3	7	2	4	2	3	10	10	6	10	-	3	6	3	0	0	6
Downy brome	7	8	7	5	10	9	9	4	4	3	0	0	6	4	8	2	4	3	0	9	4	0	10	0	0	7	3	0	0	0
Giant f xtail	9	9	7	4	10	10	9	6	4	4	3	6	5	4	9	0	6	3	0	8	5	4	10	0	0	4	-	0	1	0
Green foxtail	8	7	5	3	10	9	9	7	0	4	4	6	5	4	9	2	6	3	0	10	6	4	10	0	0	5	0	0	0	0
Jims nw ed	8	10	9	7	7	10	9	9	8	6	7	8	10	10	10	6	7	8	6	10	10	7	10	6	10	10	8	10	9	10
J hnsongrass	10	9	9	7	10	10	10	8	8	6	6	8	8	7	9	5	6	6	3	10	6	5	10	2	2	8	4	3	6	2
Lambsquarters	9	10	8	8	10	10	10	10	10	10	10	10	10	5	-	5	-	-	-	10	-	10	10	-	-	-	-	-	-	8
M rningglory	9	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	8	9	10	10	10	9	10	10	10	10	10	10	10
Nutsedge	10	10	10	10	10	10	10	10	10	3	10	10	10	9	10	10	7	10	10	-	10	10	10	4	10	10	8	-	10	9
Rap	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Rice Dry S ed	10	10	9	8	10	10	10	9	8	5	3	6	5	6	7	4	7	6	6	9	9	8	10	4	2	7	6	3	0	3
Sickl p d	10	10	10	8	9	10	10	9	9	4	10	10	9	10	10	4	9	9	7	10	10	9	10	0	10	10	8	10	2	-
S ybean	9	10	10	8	9	9	10	8	10	10	10	10	10	7	9	9	10	10	8	10	10	10	10	10	10	10	10	10	9	3
Sugar beet	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	10	10	10	10	10	10	10	10	10	10	9
Teaweed	8	7	5	7	8	9	5	8	6	3	5	7	8	9	10	6	7	5	7	10	9	6	10	8	6	8	6	6	4	7
V lvetleaf	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	7	10	9	8	10	10	7	10	9	7	10	10	7	9	9
Wheat	8	6	8	3	9	10	9	8	0	0	0	0	7	1	8	0	4	3	0	10	4	0	10	0	0	5	4	0	0	0
Wild buckwheat	10	10	10	9	10	9	10	10	8	7	9	10	9	8	9	5	9	7	6	10	9	9	10	10	8	10	9	6	7	7
Wild oat	10	9	8	4	10	10	6	9	0	0	0	0	5	4	5	0	4	2	0	7	0	0	9	0	0	4	3	0	0	2
Barnyardgrass	10	10	9	9	10	10	10	9	8	6	7	10	9	10	10	4	8	6	3	10	10	9	10	0	6	8	8	8	4	3

Table C

	COMPOUND																												
Rate (16 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36
PREEMERGENCE																														
Barley	8	8	3	2	10	9	2	2	0	0	2	0	7	2	6	0	6	5	3	5	3	0	5	0	0	6	6	3	3	2
Blackgrass	8	8	7	5	10	10	8	8	-	-	3	3	7	3	7	3	9	8	7	6	0	0	5	5	4	7	6	3	3	3
Chickweed	6	7	7	5	8	9	9	4	8	-	8	8	8	6	9	4	8	7	3	8	8	6	6	2	8	6	8	7	3	5
C ckl bur	8	8	-	8	9	8	4	5	0	0	7	8	7	-	7	3	10	9	8	8	7	5	8	7	-	10	8	8	7	8
C rn	8	5	3	2	2	7	4	1	0	0	0	3	7	0	4	0	8	0	5	6	4	0	10	0	7	8	5	0	0	4
Cotton	9	5	5	3	6	7	2	8	3	0	6	8	8	4	7	3	4	4	3	8	3	6	8	6	5	9	5	3	3	7
Crabgrass	9	9	8	8	8	9	7	8	8	10	7	8	5	7	9	3	5	6	3	6	5	0	7	5	8	8	7	6	7	5
Downy brome	8	8	7	3	9	10	8	4	3	0	0	3	8	3	7	0	8	6	0	4	3	0	7	3	2	6	6	3	3	5
Giant f xtail	8	9	7	4	9	9	8	7	3	0	3	3	5	0	6	0	8	6	3	9	0	0	10	2	2	7	4	0	0	3
Gr en f xtail	9	9	7	7	9	9	8	7	3	0	3	4	7	3	7	3	9	6	4	8	6	5	10	3	0	6	6	3	3	4
Jimsonweed	8	8	5	3	8	9	9	4	6	0	8	8	8	8	8	3	8	7	6	9	8	7	9	5	8	9	8	6	8	8
Johnsongrass	9	8	7	4	9	8	8	8	6	3	5	5	8	6	8	3	9	8	8	9	3	5	10	6	0	8	6	3	5	2
Lambsquarters	10	9	9	9	10	10	10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-
Morninggl ry	8	8	7	9	8	8	3	9	7	0	6	8	8	7	6	3	8	6	7	9	8	6	8	6	8	10	7	6	8	8
Nuts dge	9	9	4	8	10	9	8	3	0	0	9	9	7	3	8	6	9	5	4	8	3	5	10	5	9	9	4	6	10	7
Rap	9	10	9	8	10	10	10	10	8	6	10	9	10	9	10	5	9	10	7	10	10	10	10	10	10	10	9	7	8	10
Rice Dry Seed	10	9	9	9	10	10	9	9	6	0	4	3	7	4	8	3	8	7	7	9	6	7	10	4	2	4	5	3	3	3
Sicklepod	8	9	8	4	3	9	3	3	4	0	8	10	9	6	7	3	8	6	6	10	9	5	10	5	5	6	7	5	3	0
S yb an	9	7	9	3	10	8	5	3	3	0	4	3	8	2	5	0	6	6	3	9	4	3	8	4	5	8	6	3	2	5
Sugar beet	9	9	9	9	9	10	9	9	10	7	9	10	10	7	9	6	8	8	7	10	9	9	8	10	8	10	10	8	8	9
T aw ed	6	5	6	5	9	9	3	3	-	4	6	7	9	8	9	5	8	5	7	8	5	6	7	5	6	9	8	5	3	3
V lv tl af	9	9	3	5	9	9	9	9	10	0	9	8	9	7	8	6	9	7	8	10	9	9	9	8	10	10	8	10	8	6
Wh at	8	9	7	4	9	9	5	6	3	0	0	0	6	0	6	0	3	3	2	3	0	0	6	0	0	0	6	0	0	3
Wild buckwheat	8	9	9	8	9	9	8	8	6	3	6	7	7	6	7	3	8	6	5	8	7	7	8	10	7	8	7	7	6	-
Wild at	7	7	7	4	9	8	4	3	0	-	0	0	6	0	3	0	7	3	3	3	0	0	5	0	0	6	6	0	2	2
Barnyardgrass	9	10	10	4	10	9	9	9	5	0	6	7	10	6	10	4	9	6	5	10	3	5	10	4	3	10	6	4	2	4

Table C

	COMPOUND																													
Rat (4 g/ha) POSTEMERGENCE	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36
Barley	7	6	5	4	8	8	5	2	-	-	0	0	6	0	5	0	3	0	0	4	3	0	9	0	0	4	0	0	0	0
Blackgrass	9	9	8	4	9	8	9	7	5	0	3	3	7	4	6	0	7	5	3	8	3	0	6	0	2	3	8	3	0	2
Chickwe d	7	9	9	7	8	10	9	5	6	5	5	8	6	6	10	5	5	3	0	9	7	5	9	2	3	3	4	7	0	3
C ckl bur	8	9	7	7	7	8	8	4	10	6	10	10	10	6	7	5	8	9	7	10	10	10	10	10	10	10	8	10	8	-
Corn	4	7	7	0	0	6	6	0	2	0	9	10	8	0	9	0	6	6	2	10	5	2	9	0	2	8	2	3	0	3
C tton	9	9	9	8	8	8	9	4	8	8	7	10	9	9	7	2	6	9	6	10	10	7	9	4	8	8	9	7	5	7
Crabgrass	4	2	3	0	3	4	0	3	3	0	5	5	4	2	5	0	3	0	0	6	4	4	10	0	0	5	0	0	0	0
Downy brome	5	7	5	4	10	8	7	2	0	0	0	0	3	2	4	0	3	0	0	5	3	0	9	0	0	0	-	0	0	0
Giant f xtail	7	7	5	0	10	8	8	2	3	0	0	5	4	3	9	0	4	0	0	8	4	4	10	0	0	0	0	0	0	0
Green foxtail	5	4	3	0	7	8	7	4	0	0	3	5	4	3	7	0	3	0	0	8	3	3	10	0	0	0	0	0	0	0
Jims nw d	8	8	6	6	7	9	8	8	8	5	6	7	9	10	10	4	6	7	5	10	9	5	9	4	0	6	6	10	8	10
Johnsongrass	9	7	7	5	10	9	10	6	5	2	5	6	7	6	9	2	5	4	0	8	5	4	10	0	2	6	3	0	0	0
Lambsquarters	9	10	8	7	10	9	9	10	4	7	8	8	10	2	-	2	-	-	-	10	-	-	10	5	-	-	-	-	-	5
Morningglory	9	9	10	9	5	9	10	9	10	10	10	10	5	10	9	8	10	5	8	10	10	10	8	10	10	8	10	10	10	10
Nuts dge	10	8	9	9	10	10	10	10	5	0	8	10	10	5	9	4	7	7	10	10	10	10	10	0	4	10	0	3	0	9
Rap	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	6	10	10	9	10
Rice Dry Seed	9	8	8	7	9	9	9	8	7	4	0	5	4	4	5	2	5	4	4	8	4	3	10	0	0	4	0	0	0	0
Sickl p d	9	8	9	3	7	7	9	3	6	0	8	10	8	5	8	2	8	8	4	10	10	8	10	0	10	6	4	9	0	10
Soybean	9	10	9	6	9	9	9	8	10	8	10	10	10	7	9	4	10	10	4	10	10	7	10	10	10	9	10	10	7	2
Sugar be t	9	9	10	8	10	10	10	9	10	10	10	10	10	10	10	10	7	9	5	10	10	10	10	9	10	10	10	10	9	9
Teaweed	6	4	3	3	7	4	2	3	3	0	4	6	7	8	7	2	6	4	4	8	0	6	9	0	4	7	1	6	4	6
V lv tl af	10	10	9	9	10	10	9	9	10	5	8	9	8	10	8	7	8	7	7	8	7	7	10	6	6	6	10	6	6	8
Wheat	7	6	5	2	9	8	8	3	0	0	0	0	5	0	5	0	3	0	0	5	3	0	9	0	0	0	0	0	0	0
Wild buckwheat	9	9	9	8	8	8	9	7	6	6	7	8	8	8	8	5	7	7	3	10	8	7	9	8	6	4	6	-	5	6
Wild at	8	7	5	3	10	8	4	4	0	0	0	0	3	2	4	0	3	0	0	4	0	0	7	0	0	0	0	0	0	0
Barnyardgrass	9	9	9	7	10	9	10	8	7	0	6	8	7	8	9	2	7	3	0	10	9	6	10	0	3	0	3	0	3	0

Table C

	COMPOUND																													
Rate (4 g/ha)	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36
PREEMERGENCE																														
Barley	5	6	0	0	3	4	0	0	0	0	0	0	4	0	5	0	4	3	0	3	0	0	3	0	0	0	4	0	0	2
Blackgrass	7	5	5	5	10	9	3	3	-	-	0	3	6	0	6	0	7	7	6	3	0	0	0	2	2	5	3	0	0	0
Chickwe d	5	7	6	5	3	8	8	2	7	7	6	7	7	5	8	0	7	7	0	7	7	3	5	0	4	0	6	4	0	3
Cocklebur	6	8	7	3	9	8	4	2	0	0	7	7	7	3	6	0	10	9	7	7	5	0	7	6	6	6	6	5	7	3
Corn	3	5	0	0	0	4	2	0	0	0	0	0	6	0	3	0	4	0	3	5	0	0	6	0	5	0	0	0	0	2
Cotton	6	3	3	0	2	2	0	3	0	0	3	8	7	4	4	0	3	3	0	6	3	4	7	3	3	5	0	2	0	2
Crabgrass	8	8	7	3	8	9	7	4	8	10	5	7	3	6	8	0	3	3	0	3	4	0	6	0	2	8	3	4	6	3
Downy br me	5	6	3	0	5	4	3	2	0	0	0	0	3	2	6	0	4	3	0	3	0	0	3	2	0	0	4	0	0	4
Giant foxtail	7	5	4	3	9	8	5	6	0	0	0	0	3	0	3	0	7	3	0	4	0	0	3	0	2	2	0	0	0	0
Gr en foxtail	7	8	3	3	8	8	2	4	0	0	0	3	3	0	6	0	7	3	0	6	3	0	6	0	0	2	3	0	0	1
Jimsonwe d	3	3	4	0	8	8	8	2	5	0	6	6	7	7	7	0	4	3	3	8	6	5	8	0	2	0	6	3	4	4
Johns ngrass	6	3	3	0	3	8	8	3	3	0	3	3	7	6	7	0	8	4	3	7	0	3	7	0	0	5	4	0	3	2
Lambsquart rs	9	8	9	8	10	9	9	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	7
Morninggl ry	3	8	7	3	3	3	3	7	6	0	4	7	6	6	5	0	7	3	3	5	5	4	7	5	3	5	6	4	4	4
Nuts dge	8	7	0	7	9	9	6	0	0	0	3	8	5	0	3	3	9	4	3	8	3	0	7	4	7	2	3	4	4	-
Rape	9	9	7	7	9	9	10	5	7	0	7	6	10	7	5	0	9	9	7	8	9	6	9	7	3	6	8	3	6	9
Ric Dry Se d	8	8	8	8	9	9	4	5	4	0	0	0	6	0	7	0	7	5	6	7	3	3	9	2	0	3	3	0	2	2
Sicklepod	5	3	7	0	3	3	0	0	3	0	7	8	7	5	6	3	0	0	3	8	7	5	10	0	0	5	3	3	0	-
S ybean	5	2	2	0	8	3	2	0	0	0	0	0	7	0	4	0	4	3	0	4	3	0	6	3	0	2	2	0	0	0
Sugar beet	8	7	8	7	9	9	9	3	7	6	6	7	9	7	8	3	7	7	6	10	7	7	8	8	8	8	8	5	6	6
Teaweed	3	3	2	0	5	7	0	0	0	3	3	7	8	8	8	3	7	3	6	7	0	5	5	0	2	3	5	4	0	-
V lvetleaf	9	8	0	3	3	9	7	5	10	-	6	6	7	4	7	4	7	7	8	8	7	7	9	-	4	0	-	9	4	5
Wh at	5	7	3	0	3	5	2	2	0	0	0	0	3	0	5	0	0	3	0	0	0	0	5	0	0	0	3	0	0	0
Wild buckwheat	8	7	8	7	8	8	8	8	4	0	5	7	7	5	6	0	7	5	4	7	6	7	8	9	4	5	6	3	3	7
Wild at	6	5	3	2	3	3	2	0	0	-	0	0	3	0	3	0	5	0	0	0	0	0	3	0	0	3	3	0	0	0
Barnyardgrass	6	3	3	0	2	5	5	9	0	0	0	6	8	3	9	0	8	3	3	8	0	0	9	3	3	0	3	0	0	3

Tabl C

	COMPOUND																												
Rate (1 g/ha)	1	2	3	5	6	7	8	9	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36
POSTEMERGENCE																												
Barley	5	5	3	5	7	2	0	-	0	0	3	0	2	0	0	0	0	3	0	0	4	0	0	1	0	0	0	0
Blackgrass	7	8	8	7	8	7	4	5	0	0	3	2	3	0	6	3	0	3	3	0	0	0	0	0	0	2	0	0
Chickw ed	5	8	8	5	8	8	2	6	3	6	3	4	7	3	3	0	0	7	4	4	6	0	0	0	0	5	0	0
Cocklebur	3	6	7	5	5	6	2	8	9	10	9	4	5	0	6	7	4	10	10	8	10	6	10	9	6	4	6	6
Corn	2	4	7	0	3	2	0	0	3	3	7	0	7	0	5	5	0	8	0	0	6	0	0	0	0	0	0	0
Cotton	8	5	7	5	7	8	2	6	3	10	7	2	6	0	5	7	3	6	9	5	6	0	5	4	0	3	5	-
Crabgrass	2	2	0	0	2	0	0	2	3	4	4	0	2	0	3	0	0	0	0	3	8	0	0	0	0	0	0	0
Downy brome	2	5	3	6	6	6	0	0	0	0	2	2	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Giant foxtail	4	5	2	7	6	5	0	0	0	0	0	0	4	0	3	0	0	5	0	0	6	0	0	0	0	0	0	0
Green foxtail	2	2	0	2	5	5	2	0	0	3	3	1	4	0	0	0	0	3	0	0	6	0	-	0	0	0	0	0
Jimsonw d	6	7	3	6	8	7	3	5	0	6	7	7	8	0	5	5	4	10	8	5	7	0	0	0	0	6	5	5
J hns ngrass	7	6	4	8	8	9	2	3	3	3	5	4	8	0	3	0	0	6	0	3	7	0	0	5	0	0	0	0
Lambsquarters	7	5	7	5	8	9	10	-	2	-	10	2	-	0	-	-	-	-	-	10	7	0	7	6	-	-	-	-
M rningglory	8	9	9	2	9	8	8	9	6	10	3	8	7	7	7	0	6	10	10	9	6	3	4	4	9	5	9	10
Nutsedge	9	4	9	10	10	9	3	-	3	10	10	5	4	0	6	5	3	10	6	0	9	0	0	9	0	0	0	0
Rape	10	10	10	8	10	10	9	10	10	10	10	9	10	8	10	10	6	10	7	10	10	9	10	6	9	9	8	10
Rice Dry Seed	9	5	6	7	6	5	4	4	0	3	3	2	5	0	4	3	3	4	0	3	9	0	0	0	0	0	0	0
Sicklepod	9	7	9	2	5	8	0	4	6	8	6	0	3	0	5	7	2	3	9	0	6	0	7	5	0	0	0	0
S yb an	8	9	9	8	9	9	3	9	9	9	6	4	8	0	10	7	0	10	10	5	6	0	2	0	8	9	0	-
Sugar beet	8	9	10	10	10	9	8	10	10	10	9	9	10	8	6	6	4	10	10	10	10	6	10	10	9	7	6	7
Teaweed	2	2	0	2	2	0	0	0	3	3	5	6	6	0	4	3	3	4	0	2	5	0	0	0	0	5	0	0
Velvetleaf	9	8	8	10	8	8	7	8	7	8	7	6	8	3	7	6	5	7	7	6	9	5	5	5	6	6	0	5
Wh at	4	4	3	6	5	6	0	0	0	0	3	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Wild buckwheat	7	8	8	7	5	7	7	5	6	7	7	3	6	0	5	7	0	7	5	0	8	4	6	2	5	0	0	5
Wild at	5	4	3	8	3	2	2	0	0	0	0	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
Barnyardgrass	6	7	9	6	8	8	3	3	5	7	7	6	9	0	3	0	0	10	8	4	10	0	0	0	0	0	0	0

Table C

	COMPOUND																												
Rate (1 g/ha)	1	2	3	5	6	7	8	9	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36
PREEMERGENCE																												
Barl y	2	3	0	0	2	0	0	0	0	0	2	0	3	0	3	0	0	0	0	0	0	0	0	0	2	0	0	0
Blackgrass	5	5	3	3	3	0	0	-	0	0	4	0	4	0	6	3	3	0	0	0	0	0	2	0	0	0	0	0
Chickw ed	5	5	4	0	5	7	0	5	0	6	6	0	7	0	4	0	0	7	5	0	3	0	0	0	3	3	0	0
Cockl bur	0	3	3	8	2	0	0	0	3	6	7	3	5	0	7	7	6	6	3	0	5	0	-	4	-	3	7	0
Corn	-	2	0	0	0	0	0	0	0	0	2	0	0	0	2	0	2	2	0	0	5	0	4	0	0	0	0	0
C tton	3	0	0	0	0	0	0	0	0	4	4	4	3	0	2	0	0	5	3	3	6	0	0	3	0	0	0	0
Crabgrass	7	5	4	3	5	3	0	8	3	3	0	5	5	0	0	0	0	3	0	0	5	0	0	0	3	4	3	2
Downy brome	4	3	0	0	2	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	3	0	0	0
Giant foxtail	4	3	0	5	4	2	4	0	0	0	0	0	0	0	4	0	0	0	0	0	3	0	0	0	0	0	0	0
Green foxtail	3	4	0	2	4	0	0	0	0	2	0	0	5	0	5	0	0	5	3	0	4	0	0	0	0	0	0	0
Jims nweed	0	0	0	3	2	3	0	4	0	4	4	4	6	0	2	2	0	6	3	3	7	0	0	0	3	2	3	3
Johnsongrass	2	3	0	0	2	2	0	0	0	0	6	5	6	0	3	0	0	5	0	0	6	0	0	0	0	0	0	0
Lambsquarters	5	8	9	7	3	8	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	4
M rningglory	0	3	3	0	0	0	3	3	3	6	4	6	5	0	3	0	0	4	4	3	6	2	0	3	4	4	3	0
Nuts dge	6	5	0	8	3	2	0	0	3	3	4	0	0	0	3	3	0	6	3	0	5	3	-	0	2	3	3	6
Rap	7	8	7	8	7	7	2	3	3	0	5	3	3	0	8	7	5	3	0	0	8	0	3	4	5	0	3	5
Ric Dry Seed	8	4	4	3	4	2	2	3	0	0	3	0	6	0	6	3	0	3	3	0	9	0	0	0	3	0	0	0
Sickl pod	2	0	5	0	0	0	0	0	5	3	5	3	5	0	0	0	-	5	4	5	8	0	0	0	0	0	0	0
Soyb an	0	0	0	2	0	0	0	0	0	0	0	0	4	0	2	0	0	3	-	0	2	0	0	0	0	0	0	0
Sugar beet	7	7	7	9	8	9	0	6	3	5	8	6	4	0	6	6	6	8	5	3	7	0	4	5	5	4	6	2
Teaweed	0	0	0	0	2	0	0	0	0	5	3	8	8	0	3	0	3	3	0	4	3	0	0	-	0	0	0	0
Velvetleaf	5	3	0	0	3	3	2	10	3	6	6	3	7	0	5	4	-	7	6	7	8	0	0	-	3	7	3	4
Wh at	3	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Wild buckwh at	7	3	8	2	7	2	3	3	3	5	6	3	5	0	5	4	3	5	5	0	8	3	0	4	3	0	0	0
Wild oat	4	3	0	0	3	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	2	0	0	0	0
Barnyardgrass	2	0	0	0	2	2	3	0	0	4	7	0	6	0	5	0	0	5	0	0	6	0	2	0	0	0	0	0

TEST D

The compounds evaluated in this test were formulated in a non-phytoxic solvent and applied to the soil surface before plant seedlings emerged (preemergence application), to water that covered the soil surface (paddy application), and to plants that were in the one-to-four leaf stage (postemergence application). A sandy loam soil was used for the preemergence and postemergence tests, while a silt loam soil was used in the paddy test. Water depth was approximately 2.5 cm for the paddy test and was maintained at this level for the duration of the test.

Plant species in the preemergence and postemergence tests consisted of barley (Hordeum vulgare), bedstraw (Galium aparine), blackgrass (Alopecurus myosuroides), chickweed (Stellaria media), corn (Zea mays), cotton (Gossypium hirsutum), crabgrass (Digitaria sanguinalis), downy brome (Bromus tectorum), giant foxtail (Setaria faberii), lambsquarters (Chenopodium album), morningglory (Ipomoea hederacea), pigweed (Amaranthusretroflexus), rape (Brassica napus), ryegrass (Lolium multiflorum), sorghum (Sorghum bicolor), soybean (Glycine max), speedwell (Veronica persica), sugar beet (Beta vulgaris), velvetleaf (Abutilon theophrasti), wheat (Triticum aestivum), wild buckwheat (Polygonum convolvulus), and wild oat (Avena fatua). All plant species were planted one day before application of the compound for the preemergence portion of this test. Plantings of these species were adjusted to produce plants of appropriate size for the postemergence portion of the test. Plant species in the paddy t st consisted of barnyardgrass

(Echinochloa crus-galli), rice (Oryza sativa), and umbrella sedge (Cyperus difformis).

All plant species were grown using normal greenhouse practices. Visual evaluations of injury expressed on treated plants, when compared to untreated controls, were recorded approximately fourteen to twenty-one days after application of the test compound. Plant response ratings, summarized in Table D, were recorded on a 0 to 10 scale where 0 is no injury and 10 is complete control. A dash (-) response means no test result.

Tabl D

	COMPOUND					
Rate (62 g/ha)	32	35	40	41	42	43
POSTEMERGENCE						
Barley Igri	9	10	10	5	10	6
Bedstraw	10	10	10	10	10	10
Blackgrass	9	10	10	10	10	10
Chickweed	10	10	10	10	10	10
Corn	10	10	10	9	10	8
Cotton	10	10	10	10	10	10
Crabgrass	7	10	6	0	3	4
Downy brome	9	10	9	6	10	8
Duck salad	-	-	-	9	9	-
Giant foxtail	10	10	10	7	10	9
Lambsquarters	10	10	10	10	10	10
Morningglory	10	10	10	10	10	10
Pigweed	10	10	10	10	10	10
Rape	10	10	10	10	10	10
Ryegrass	10	10	10	3	5	7
Sorghum	10	10	10	7	10	10
Soybean	10	10	10	7	10	9
Speedwell	9	10	10	10	8	9
Sugar beet	10	10	10	10	10	10
Velvetleaf	10	10	10	10	9	10
Wheat	9	9	9	3	9	7
Wild buckwheat	10	10	10	10	9	8
Wild oat	9	9	6	5	4	7
Barnyardgrass	9	10	9	9	10	9
Rice Japonica	8	8	8	8	8	9
Umbrella sedge	10	10	9	9	9	9

Table D

	COMPOUND					
Rate (62 g/ha)	32	35	40	41	42	43
PREEMERGENCE						
Barley Igri	9	5	4	2	9	2
Bedstraw	9	9	10	10	10	10
Blackgrass	9	7	9	7	9	10
Chickweed	10	-	10	9	9	9
Corn	8	10	2	3	7	3
Cotton	6	9	9	10	10	7
Crabgrass	8	10	7	8	5	7
Downy brome	10	7	7	7	10	7
Giant foxtail	7	9	4	6	7	7
Lambsquarters	10	-	10	9	10	10
Morningglory	8	8	10	10	9	8
Pigweed	10	10	10	9	10	9
Rape	10	9	10	10	9	10
Ryegrass	10	10	6	6	7	8
Sorghum	9	10	9	7	10	9
Soybean	7	9	7	0	9	4
Speedwell	10	9	10	9	10	9
Sugar beet	10	9	9	10	10	10
Velvetleaf	8	9	9	8	9	9
Wheat	9	7	4	2	9	4
Wild buckwheat	9	8	9	8	9	9
Wild oat	6	5	5	3	3	3

Tabl D

	COMPOUND										
Rate (31 g/ha)	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley Igri	9	9	9	10	6	10	4	9	4	9	5
Bedstraw	10	10	10	10	10	10	10	10	10	10	10
Blackgrass	9	9	9	10	10	10	9	10	9	10	10
Chickweed	10	10	10	10	10	10	10	10	10	10	10
Corn	10	10	10	10	8	10	7	10	8	10	7
Cotton	10	10	10	10	10	10	10	10	10	10	9
Crabgrass	6	7	10	10	0	8	0	5	0	0	3
Downy brome	8	10	10	10	5	10	4	9	5	10	7
Duck salad	-	-	-	-	-	-	-	-	7	8	-
Giant foxtail	8	10	10	10	6	10	6	10	5	7	8
Lambsquarters	10	10	10	10	10	10	-	10	10	10	10
Morningglory	10	8	8	10	10	10	10	10	10	10	10
Pigweed	10	10	10	10	10	10	0	10	8	10	9
Rape	10	10	10	10	10	10	10	10	10	10	10
Ryegrass	9	10	10	10	0	10	4	10	2	4	7
Sorghum	10	10	10	10	10	10	7	10	6	10	10
Soybean	10	10	10	10	10	10	10	10	7	10	9
Speedwell	9	8	8	10	5	8	9	9	10	8	8
Sugar beet	10	10	10	10	10	10	10	10	10	10	10
Velvetleaf	10	10	10	10	8	10	10	10	10	9	10
Wheat	9	9	9	9	4	9	2	9	0	8	7
Wild buckwheat	10	10	10	10	10	10	9	10	10	9	7
Wild oat	8	9	10	7	3	9	4	5	4	4	6
Barnyardgrass	9	8	9	9	8	9	7	9	8	9	9
Rice Japonica	8	8	9	8	7	9	8	8	8	8	9
Umbrella sedge	10	9	10	10	9	9	9	9	9	9	9

Table D

	COMPOUND										
Rate (31 g/ha)	32	33	34	35	37	38	39	40	41	42	43
PREEMERGENCE											
Barley Igri	8	3	7	4	3	4	0	2	0	7	2
Bedstraw	8	9	10	9	10	8	9	10	9	10	10
Blackgrass	9	10	8	6	9	8	7	9	6	9	9
Chickweed	10	10	10	-	10	9	8	10	9	9	7
Corn	5	8	9	10	0	6	3	0	0	7	2
Cotton	6	7	8	9	7	8	3	7	6	9	5
Crabgrass	8	7	8	10	3	7	0	7	6	4	5
Downy brome	8	8	10	6	4	8	4	5	6	9	5
Giant foxtail	6	8	8	9	2	7	10	3	6	6	4
Lambsquarters	10	10	10	-	10	10	9	10	9	10	9
Morningglory	8	6	7	7	6	3	6	10	9	9	3
Pigweed	10	9	9	10	8	8	7	10	9	9	9
Rape	10	9	9	8	10	10	10	10	10	9	10
Ryegrass	9	10	10	9	4	5	5	4	6	6	5
Sorghum	8	9	10	10	5	10	7	9	4	7	9
Soybean	6	7	2	7	0	6	0	6	0	9	4
Speedwell	10	10	10	8	9	10	10	10	9	9	9
Sugar beet	9	9	10	9	10	9	9	9	10	10	9
Velvetleaf	8	9	7	9	8	8	7	8	8	8	8
Wheat	6	6	6	6	0	3	0	3	1	5	2
Wild buckwheat	9	9	8	8	8	9	8	8	7	9	9
Wild oat	4	4	5	4	0	0	0	3	2	0	0

Table D

	COMPOUND										
Rate (16 g/ha)	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley Igri	8	9	9	10	5	9	4	8	3	9	4
Bedstraw	10	10	10	10	10	10	10	10	10	10	9
Blackgrass	9	9	9	10	10	10	8	9	9	10	10
Chickweed	10	9	10	10	10	10	10	10	10	10	7
Corn	10	10	10	10	8	10	6	10	6	10	6
Cotton	9	10	10	10	10	10	10	10	10	10	9
Crabgrass	5	6	9	9	0	7	0	4	0	0	0
Downy brome	7	9	9	8	4	10	4	5	4	10	6
Duck salad	-	-	-	-	-	-	-	-	1	7	-
Giant foxtail	7	9	10	10	6	10	5	10	3	6	8
Lambsquarters	10	10	10	10	10	10	10	10	10	10	9
Morningglory	10	7	7	10	10	10	10	10	10	10	9
Pigweed	10	9	10	10	7	9	0	10	7	5	8
Rape	10	10	10	10	10	10	10	10	10	10	10
Ryegrass	9	10	10	10	0	10	4	9	0	4	6
Sorghum	10	10	10	10	10	10	6	10	6	10	10
Soybean	10	10	10	10	10	10	10	10	7	10	9
Speedwell	8	8	8	9	5	8	9	8	10	7	7
Sugar beet	10	10	10	10	10	10	10	10	10	10	8
Velvetleaf	10	10	10	10	7	10	7	10	10	5	9
Wheat	6	9	9	4	4	9	0	7	0	8	7
Wild buckwheat	10	10	9	10	10	10	8	10	10	9	6
Wild oat	4	8	9	5	2	9	4	4	4	4	5
Barnyardgrass	8	8	9	9	5	9	5	7	6	9	8
Rice Japonica	8	8	8	8	7	8	7	8	6	8	8
Umbrella sedge	9	9	10	9	9	9	5	9	9	9	9

Table D

	COMPOUND										
Rate (16 g/ha)	32	33	34	35	37	38	39	40	41	42	43
PREEMERGENCE											
Barley Igri	7	3	6	3	0	2	0	1	0	6	1
Bedstraw	8	9	10	9	10	8	9	9	9	10	10
Blackgrass	9	8	7	6	6	7	5	8	5	9	9
Chickweed	9	10	10	-	10	9	8	9	8	9	4
Corn	4	8	2	4	0	0	2	0	0	2	0
Cotton	6	7	8	7	7	7	2	5	-	9	5
Crabgrass	6	7	7	10	2	5	0	6	6	3	3
Downy brome	8	7	8	4	0	3	3	4	5	9	2
Giant foxtail	5	8	7	8	0	6	2	3	6	4	4
Lambsquarters	10	10	10	-	9	9	8	8	9	9	9
Morningglory	6	5	3	7	6	3	2	10	7	9	2
Pigweed	9	9	9	10	8	8	7	10	9	9	8
Rape	10	9	9	8	9	9	8	9	10	9	10
Ryegrass	9	10	10	9	0	4	4	4	3	6	5
Sorghum	3	9	6	10	2	10	4	3	4	4	9
Soybean	6	6	2	6	0	3	0	5	0	7	2
Speedwell	10	9	10	8	8	8	9	9	8	9	9
Sugar beet	9	9	9	9	9	9	9	8	10	10	9
Velvetleaf	7	8	7	8	8	7	7	7	7	7	7
Wheat	6	4	4	3	0	0	0	1	0	5	0
Wild buckwheat	8	8	7	7	8	9	7	7	7	9	8
Wild oat	0	3	3	3	0	0	0	0	0	0	0

Table D

	COMPOUND										
Rate (8 g/ha)	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley Igri	8	8	9	9	4	9	3	7	0	9	3
Bedstraw	10	10	10	10	10	10	10	10	10	10	8
Blackgrass	9	9	8	10	7	10	6	9	9	10	9
Chickweed	9	9	10	10	10	10	10	10	10	10	7
Corn	10	8	10	10	7	9	2	10	2	10	5
Cotton	9	9	10	10	10	10	10	10	10	10	9
Crabgrass	0	5	8	7	0	6	0	3	0	0	0
Downy brome	5	6	9	8	4	9	3	4	3	10	4
Duck salad	-	-	-	-	-	-	-	-	0	0	-
Giant foxtail	6	7	10	9	5	10	3	10	0	4	7
Lambsquarters	10	8	10	9	10	10	10	10	10	10	8
Morningglory	8	6	7	8	10	10	10	10	10	10	7
Pigweed	10	8	10	9	7	7	0	10	6	4	8
Rape	10	10	10	10	10	10	10	10	10	10	10
Ryegrass	6	9	10	10	0	9	3	7	0	2	5
Sorghum	7	10	10	10	10	10	6	10	5	9	10
Soybean	10	10	10	9	10	10	10	10	7	10	9
Speedwell	8	7	8	9	4	8	9	-	10	6	7
Sugar beet	10	9	10	10	10	10	10	10	10	10	8
Velvetleaf	10	10	10	10	7	10	7	10	10	5	9
Wheat	5	6	9	4	0	8	0	5	0	7	6
Wild buckwheat	10	8	9	9	9	10	8	10	9	9	6
Wild oat	4	6	9	3	2	8	3	0	2	2	3
Barnyardgrass	7	7	9	9	4	7	1	6	4	6	8
Rice Japonica	8	8	8	8	6	8	1	8	1	6	8
Umbrella sedge	9	9	9	9	6	9	4	9	7	6	9

Table D

	COMPOUND										
Rate (8 g/ha)	32	33	34	35	37	38	39	40	41	42	43
PREEMERGENCE											
Barley Igri	2	0	3	0	0	0	0	0	0	5	0
Bedstraw	-	9	9	8	7	6	7	7	7	9	9
Blackgrass	8	8	7	5	4	6	4	7	4	9	6
Chickweed	9	10	10	-	10	9	7	9	5	9	4
Corn	0	7	0	2	0	0	0	0	0	0	0
Cotton	5	7	7	7	4	6	2	4	4	9	4
Crabgrass	4	4	6	8	0	3	0	6	6	3	2
Downy brome	6	6	8	3	0	0	0	3	3	5	2
Giant foxtail	5	3	2	8	0	4	0	3	5	3	2
Lambsquarters	9	9	9	-	6	7	8	8	7	8	8
Morningglory	5	4	3	7	3	2	0	9	4	8	0
Pigweed	9	8	9	10	7	7	7	10	8	9	7
Rape	9	9	9	8	7	8	5	7	9	9	7
Ryegrass	4	8	10	7	0	2	2	2	2	4	0
Sorghum	0	9	4	10	0	4	2	0	3	3	7
Soybean	4	4	0	5	0	0	0	-	0	6	0
Speedwell	8	9	10	8	8	7	-	8	8	8	8
Sugar beet	9	9	9	8	8	8	7	8	9	10	9
Velvetleaf	6	8	7	8	4	6	3	7	7	7	7
Wheat	0	3	3	0	0	0	0	0	0	4	0
Wild buckwheat	7	8	7	7	7	8	6	7	7	8	7
Wild oat	0	2	2	0	0	0	0	0	0	0	0

Table D

	COMPOUND										
Rate (4 g/ha)	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley Igri	6	7	7	6	4	8	2	5	0	7	0
Bedstraw	9	8	10	10	10	10	10	10	10	10	7
Blackgrass	9	8	8	9	6	9	5	9	0	10	8
Chickweed	9	8	10	10	10	10	10	10	10	10	7
Corn	10	7	7	9	3	8	2	10	0	10	4
Cotton	9	8	10	10	10	10	9	9	10	9	8
Crabgrass	0	4	6	5	0	4	0	2	0	0	0
Downy brome	3	4	8	0	2	4	0	4	0	9	3
Duck salad	-	-	-	-	-	-	-	-	0	0	-
Giant foxtail	5	6	10	8	3	7	3	6	0	2	4
Lambsquarters	10	8	10	8	9	10	10	10	9	10	7
Morningglory	6	4	6	7	10	10	10	10	10	10	3
Pigweed	7	8	10	9	7	7	0	10	5	4	4
Rape	10	10	10	10	9	10	10	10	10	10	10
Ryegrass	5	9	9	10	0	7	0	5	0	0	3
Sorghum	7	9	10	10	7	10	6	10	3	8	10
Soybean	10	10	10	9	10	10	10	10	7	10	9
Speedwell	8	7	7	8	3	8	7	6	9	5	5
Sugar beet	9	8	10	10	10	10	10	10	10	10	8
Velvetleaf	10	10	9	10	7	10	6	10	10	2	9
Wheat	4	4	7	0	0	5	0	3	0	7	4
Wild buckwheat	9	8	9	7	9	10	-	8	9	7	6
Wild oat	2	4	6	0	0	5	2	0	0	0	0
Barnyardgrass	4	5	8	8	0	6	0	2	2	5	5
Rice Japonica	8	8	8	8	2	8	0	7	0	0	7
Umbrella sedge	9	8	9	9	3	9	1	9	3	5	9

Table D

	COMPOUND										
Rate (4 g/ha)	32	33	34	35	37	38	39	40	41	42	43
PREEMERGENCE											
Barley Igri	0	0	0	0	0	0	0	0	0	4	0
Bedstraw	8	8	8	8	6	6	5	7	6	9	9
Blackgrass	7	7	6	4	3	3	3	5	2	8	0.
Chickweed	4	10	10	-	9	8	7	8	5	9	0
Corn	0	6	0	2	0	0	0	0	0	0	0
Cotton	3	7	5	6	2	4	2	3	4	8	3
Crabgrass	4	4	4	7	0	2	0	3	3	3	2
Downy brome	6	4	7	3	0	0	0	3	2	3	0
Giant foxtail	3	3	0	6	0	3	0	0	4	0	0
Lambsquarters	8	9	9	-	6	-	6	8	7	7	8
Morningglory	4	2	2	4	2	0	0	4	0	7	0
Pigweed	9	8	8	10	7	5	4	8	7	7	7
Rape	9	8	8	8	7	8	3	7	7	9	3
Ryegrass	2	6	3	7	0	0	0	0	2	0	0
Sorghum	0	9	4	7	0	2	0	0	3	0	4
Soybean	4	2	0	2	0	0	0	3	0	6	0
Speedwell	8	9	9	8	5	-	9	8	8	8	6
Sugar beet	-	8	8	8	8	8	7	7	7	9	8
Velvetleaf	6	7	6	7	2	5	2	5	6	6	5
Wheat	0	0	0	0	0	0	0	0	0	0	0
Wild buckwheat	7	8	7	7	7	8	5	7	4	8	4
Wild oat	0	0	0	0	0	0	0	0	0	0	0

Table D

	COMPOUND				
Rate (2 g/ha)	33	34	37	38	39
POSTEMERGENCE					
Barley Igri	5	7	3	5	2
Bedstraw	8	10	10	8	8
Blackgrass	7	7	6	8	4
Chickweed	6	9	10	10	8
Corn	7	7	0	7	0
Cotton	5	8	10	8	6
Crabgrass	3	4	0	0	0
Downy brome	2	6	0	3	0
Giant foxtail	5	10	3	5	2
Lambsquarters	7	8	8	10	7
Morningglory	2	4	10	10	10
Pigweed	6	10	0	3	0
Rape	10	10	8	10	10
Ryegrass	6	8	0	4	0
Sorghum	7	9	7	10	6
Soybean	10	9	10	10	10
Speedwell	5	7	3	6	6
Sugar beet	8	10	10	9	10
Velvetleaf	7	7	7	7	6
Wheat	4	6	0	4	0
Wild buckwheat	3	9	7	9	7
Wild oat	3	4	0	4	0
Barnyardgrass	0	-	0	3	0
Rice Japonica	7	7	1	7	0
Umbrella sedge	7	9	3	9	0

Table D

	COMPOUND				
Rate (2 g/ha)	33	34	37	38	39
PREEMERGENCE					
Barley Igri	0	0	0	0	0
Bedstraw	8	8	5	5	4
Blackgrass	6	5	2	3	3
Chickweed	10	10	9	5	6
Corn	4	0	0	0	0
Cotton	6	5	0	2	0
Crabgrass	2	0	0	0	0
Downy brome	3	6	0	0	0
Giant foxtail	2	0	0	0	0
Lambsquarters	9	9	5	6	5
Morningglory	0	0	0	0	0
Pigweed	7	7	6	5	4
Rape	8	8	6	5	0
Ryegrass	4	7	0	0	0
Sorghum	5	2	0	0	0
Soybean	0	0	0	0	0
Speedwell	9	8	-	4	7
Sugar beet	8	8	6	7	6
Velvetleaf	6	6	0	3	0
Wheat	0	0	0	0	0
Wild buckwheat	7	7	7	6	4
Wild oat	0	0	0	0	0

TEST E

Seeds of barnyardgrass (Echinochloa crus-galli), cocklebur (Xanthium pensylvanicum), corn (Zea mays) (soil surface exposed and soil surface covered with perlite), crabgrass (Digitaria spp.), fall panicum (Panicum dichotomiflorum), giant foxtail (Setaria faberii), green foxtail (Setaria viridis), ivyleaf morningglory (Ipomoea hederacea), jimsonweed (Datura stramonium), johnsongrass (Sorghum halepense), ladysthumb smartweed (Polygonum persicaria), lambsquarters (Chenopodium album), redroot pigweed (Amaranthus retroflexus), sorghum (Sorghum bicolor), soybean (Glycine max), and velvetleaf (Abutilon theophrasti) and purple nutsedge (Cyperus rotundus) tubers were planted and treated preemergence with test chemicals dissolved in a non-phytotoxic solvent. These crop and weed species were also treated with postemergence applications of test compounds. Plants ranged in height from two to twenty-five cm for postemergence treatments.

Treated plants and controls were maintained in a greenhouse for approximately 24 days, after which all species were compared to controls and visually evaluated. The ratings, summarized in Table E, are based on a scale of 0 to 10 where 0 is no effect and 10 is complete control. A dash (-) response means no test result.

Table E

	COMPOUND
Rate (500 g/ha)	5
PREEMERGENCE	
Barnyardgrass	10
Cocklebur	10
Corn	6
Crabgrass	10
Fall panicum	10
Giant foxtail	10
Green foxtail	10
Ivlf mrninglory	10
Jimsonweed	10
Johnsongrass	10
Ladysthmb smtwd	10
Lambsquarters	10
Purple nutsedge	10
Redroot pigweed	10
Sorghum	10
Soybean	10
Velvetleaf	10

Table E

	COMPOUND				
Rate (250 g/ha)	5	7	8	9	10
PREEMERGENCE					
Barnyardgrass	10	10	10	10	7
Cocklebur	10	9	6	8	2
Corn	3	9	4	6	0
Crabgrass	9	9	6	8	2
Fall panicum	10	10	7	9	4
Giant foxtail	10	10	10	9	4
Green foxtail	10	10	9	9	3
Ivlf mrninglory	10	9	9	9	3
Jimsonweed	10	4	6	9	2
Johnsongrass	10	10	10	10	6
Ladysthmb smtwd	10	-	-	10	9
Lambsquarters	10	-	-	-	-
Purple nutsedge	10	10	10	10	4
Redroot pigweed	10	10	10	10	10
Sorghum	10	10	10	10	9
Soybean	10	-	-	8	7
Velvetleaf	10	8	8	6	4

Table E

	COMPOUND				
Rate (125 g/ha)	5	7	8	9	10
POSTEMERGENCE					
Barnyardgrass	10	10	10	10	9
Cocklebur	10	10	10	10	10
Corn	7	10	2	6	0
Crabgrass	10	10	7	2	0
Fall panicum	10	10	9	2	0
Giant foxtail	10	10	8	4	2
Green foxtail	10	10	9	4	4
Ivlf mrninglory	10	10	10	10	10
Jimsonweed	10	10	10	10	10
Johnsongrass	10	10	10	10	10
Ladysthmb smtwd	10	-	-	10	6
Lambsquarters	9	10	9	7	6
Perlite corn	5	6	2	4	0
Purple nutsedge	10	10	10	10	4
Redroot pigweed	10	10	10	10	10
Sorghum	10	10	10	10	10
Soybean	10	10	10	10	10
Velvetleaf	10	10	10	10	10

Tabl E

	COMPOUND				
Rate (125 g/ha)	5	7	8	9	10
PREEMERGENCE					
Barnyardgrass	10	10	10	9	4
Cocklebur	8	7	3	6	0
Corn	2	6	2	4	0
Crabgrass	7	7	5	5	0
Fall panicum	10	7	6	6	2
Giant foxtail	10	9	9	7	0
Green foxtail	10	8	8	6	0
Ivlf mrninglory	8	7	7	8	2
Jimsonweed	9	2	3	7	0
Johnsongrass	10	10	10	9	5
Ladysthmb smtwd	10	-	-	10	6
Lambsquarters	10	-	-	-	-
Purple nutsedge	10	10	9	9	0
Redroot pigweed	10	10	10	10	9
Sorghum	10	10	10	9	7
Soybean	9	-	-	6	4
Velvetleaf	9	6	6	3	2

Table E

	COMPOUND					
Rate (64 g/ha)	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	10	10	10	10	8	9
Cocklebur	10	10	10	10	10	10
Corn	3	9	0	3	0	0
Crabgrass	10	9	5	0	0	0
Fall panicum	10	10	7	0	0	0
Giant foxtail	10	9	7	2	0	0
Green foxtail	10	10	8	2	2	0
Ivlf mrninglory	10	10	9	10	10	10
Jimsonweed	10	7	10	9	10	9
Johnsongrass	10	10	10	10	7	7
Ladysthmb smtwd	10	-	-	10	5	9
Lambsquarters	8	9	8	6	4	7
Perlite corn	2	4	0	2	0	0
Purple nutsedge	10	10	10	10	2	10
Redroot pigweed	8	10	10	10	10	10
Sorghum	10	10	10	10	9	8
Soybean	10	10	10	10	10	10
Velvetleaf	10	10	10	10	10	10

Table E

	COMPOUND				
Rate (64 g/ha)	5	7	8	9	10
PREEMERGENCE					
Barnyardgrass	10	10	8	7	2
Cocklebur	5	7	0	2	0
Corn	0	4	0	3	0
Crabgrass	5	5	3	3	0
Fall panicum	10	6	4	3	0
Giant foxtail	9	6	6	4	0
Green foxtail	10	5	4	3	0
Ivlf mrninglory	6	6	5	5	0
Jimsonweed	6	0	0	4	0
Johnsongrass	10	10	10	7	3
Ladysthmb smtwd	9	-	-	8	4
Lambsquarters	10	-	-	-	-
Purple nutsedge	10	8	8	7	0
Redroot pigweed	10	10	10	10	8
Sorghum	10	10	10	6	5
Soybean	7	-	-	4	2
Velvetleaf	6	5	2	2	0

Table E

	COMPOUND					
Rate (32 g/ha)	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	10	10	10	10	6	6
Cocklebur	10	10	10	10	10	10
Corn	0	6	0	0	0	0
Crabgrass	6	8	3	0	0	0
Fall panicum	10	8	4	0	0	0
Giant foxtail	10	9	5	0	0	0
Green foxtail	10	10	8	0	0	0
Ivlf mrninglory	10	10	8	9	10	10
Jimsonweed	8	6	8	9	10	8
Johnsongrass	10	10	10	10	6	5
Ladysthmb smtwd	9	-	-	9	5	9
Lambsquarters	7	7	7	4	2	6
Perlite corn	0	3	0	0	0	0
Purple nutsedge	10	10	9	9	2	10
Redroot pigweed	7	10	10	10	10	9
Sorghum	10	10	10	10	8	5
Soybean	10	10	10	10	10	10
Velvetleaf	10	10	9	9	9	10

Table E

	COMPOUND				
Rate (32 g/ha)	5	7	8	9	10
PREEMERGENCE					
Barnyardgrass	8	6	4	3	0
Cocklebur	2	4	0	0	0
Corn	0	2	0	0	0
Crabgrass	3	2	0	0	0
Fall panicum	7	3	2	0	0
Giant foxtail	8	5	2	0	0
Green foxtail	8	4	0	0	0
Ivlf mrninglory	3	3	2	2	0
Jimsonweed	2	0	0	2	0
Johnsongrass	9	7	6	3	0
Ladysthmb smtwd	8	-	-	3	2
Lambsquarters	9	-	-	-	-
Purple nutsedge	9	7	3	3	0
Redroot pigweed	10	9	8	6	6
Sorghum	10	8	5	3	2
Soybean	5	-	-	0	0
Velvetleaf	2	3	0	0	0

Table E

	COMPOUND					
Rate (16 g/ha)	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	10	10	8	9	4	2
Cocklebur	10	10	9	10	8	10
Corn	0	4	0	0	0	0
Crabgrass	4	6	0	0	0	0
Fall panicum	8	6	3	0	0	0
Giant foxtail	9	8	3	0	0	0
Green foxtail	9	9	7	0	0	0
Ivlf mrninglory	10	9	7	9	9	10
Jimsonweed	7	4	6	7	9	8
Johnsongrass	10	10	9	9	3	2
Ladysthmb smtwd	8	-	-	8	3	7
Lambsquarters	6	6	5	2	0	5
Perlite corn	0	2	0	0	0	0
Purple nutsedge	10	10	6	8	0	7
Redroot pigweed	6	10	9	9	10	7
Sorghum	10	10	10	10	5	3
Soybean	10	10	9	10	10	10
Velvetleaf	10	10	6	7	6	10

Table E

	COMPOUND	
Rate (16 g/ha)	5	9
PREEMERGENCE		
Barnyardgrass	6	0
Cocklebur	0	0
Corn	0	0
Crabgrass	0	0
Fall panicum	4	0
Giant foxtail	4	0
Green foxtail	4	0
Ivlf mrninglory	2	0
Jimsonweed	0	0
Johnsongrass	6	0
Ladysthmb smtwd	6	0
Lambsquarters	5	-
Purple nutsedge	7	0
Redroot pigweed	6	3
Sorghum	7	0
Soybean	2	0
Velvetleaf	0	0

Table E

	COMPOUND					
Rate (8 g/ha)	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	10	10	6	7	2	0
Cocklebur	8	8	5	8	7	9
Corn	0	2	0	0	0	0
Crabgrass	2	3	0	0	0	0
Fall panicum	6	3	0	0	0	0
Giant foxtail	8	5	2	0	0	0
Green foxtail	9	8	5	0	0	0
Ivlf mrninglory	9	8	3	8	7	9
Jimsonweed	7	2	3	4	7	7
Johnsongrass	9	10	8	6	2	0
Ladysthmb smtwd	7	-	-	5	2	5
Lambsquarters	3	4	2	0	0	4
Perlite corn	0	0	0	0	0	0
Purple nutsedge	10	9	4	5	0	4
Redroot pigweed	3	9	9	8	9	7
Sorghum	10	10	9	6	3	0
Soybean	10	10	7	10	6	10
Velvetleaf	9	8	3	4	4	8

Table E

	COMPOUND					
Rate (4 g/ha)	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	9	7	2	3	0	0
Cocklebur	6	5	2	3	3	6
Corn	0	0	0	0	0	0
Crabgrass	0	0	0	0	0	0
Fall panicum	3	0	0	0	0	0
Giant foxtail	5	3	0	0	0	0
Green foxtail	7	6	3	0	0	0
Ivlf mrninglory	7	5	0	3	3	6
Jimsonweed	6	0	0	2	3	4
Johnsongrass	8	9	6	2	0	0
Ladysthmb smtwd	3	-	-	2	0	2
Lambsquarters	0	2	0	0	0	2
Perlite corn	0	0	0	0	0	0
Purple nutsedge	8	6	2	2	0	2
Redroot pigweed	0	8	5	6	6	4
Sorghum	9	9	5	2	0	0
Soybean	10	10	3	8	3	10
Velvetleaf	7	6	0	2	2	5

TEST F

Plastic pots were partially filled with silt loam soil. The soil was then saturated with water. Indica and Japonica rice (Oryza sativa) seedlings at the 2.0 to 2.5 leaf stage, seeds selected from barnyardgrass (Echinochloa crus-galli), bulrush (Scirpus mucronatus), duck salad (Heteranthera Bimosa), umbrella sedge (cyperus difformis) and tubers selected from waterchestnut (Eleocharis spp.), were planted into this soil. After planting, water levels were raised to 3 cm above the soil surface and maintained at this level throughout the test. Chemical treatments were formulated in a non-phytotoxic solvent and applied directly to the paddy water. Treated plants and controls were maintained in a greenhouse for approximately 21 days, after which all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table F, are reported on a 0 to 10 scale where 0 is no effect and 10 is complete control. A dash (-) response means no test result.

Table F

	COMPOUND
Rate (64 g/ha)	27
PADDY	
Barnyardgrass	6
Bulrush	9
Duck salad	10
Indica rice	2
Japonica rice	4
Umbrella sedge	10
Waterchestnut	10

	COMPOUND		
Rate (32 g/ha)	11	17	27
PADDY			
Barnyardgrass	8	5	6
Bulrush	9	9	9
Duck salad	10	10	10
Indica rice	3	0	2
Japonica rice	4	4	4
Umbrella sedge	10	9	10
Waterchestnut	-	-	9

	COMPOUND				
Rate (16 g/ha)	11	17	22	23	27
PADDY					
Barnyardgrass	7	4	10	7	4
Bulrush	8	9	8	9	7
Duck salad	10	10	10	10	8
Indica rice	3	0	9	4	2
Japonica rice	3	0	9	6	0
Umbrella sedge	10	9	10	10	9
Waterchestnut	-	-	10	8	9

Table F

	COMPOUND				
Rate (8 g/ha)	11	17	22	23	27
PADDY					
Barnyardgrass	6	0	9	5	4
Bulrush	7	8	8	6	6
Duck salad	10	4	10	8	7
Indica rice	2	0	8	4	0
Japonica rice	3	0	8	6	0
Umbrella sedge	9	9	10	8	7
Waterchestnut	-	-	6	2	3

	COMPOUND				
Rate (4 g/ha)	11	17	22	23	27
PADDY					
Barnyardgrass	3	0	9	4	3
Bulrush	0	2	8	0	0
Duck salad	9	0	10	3	0
Indica rice	0	0	6	2	0
Japonica rice	0	0	7	4	0
Umbrella sedge	9	7	10	6	5
Waterchestnut	-	-	4	2	3

	COMPOUND			
Rate (2 g/ha)	11	17	22	23
PADDY				
Barnyardgrass	3	0	7	2
Bulrush	0	0	2	0
Duck salad	7	0	9	2
Indica rice	0	0	4	0
Japonica rice	0	0	7	4
Umbrella sedge	7	0	8	3
Waterchestnut	-	-	3	2

Table F

	COMPOUND	
Rate (1 g/ha)	22	23
PADDY		
Barnyardgrass	6	0
Bulrush	2	0
Duck salad	3	0
Indica rice	4	0
Japonica rice	6	4
Umbrella sedge	4	2
Waterchestnut	2	2

TEST G

Compounds evaluated in this test were formulated in a non-phytoxic solvent and applied to the soil surface before plant seedlings emerged (preemergence application) and to plants that were in the one-to-four leaf stage (postemergence application). A sandy loam soil was used for the preemergence test while a mixture of sandy loam soil and greenhouse potting mix in a 60:40 ratio was used for the postemergence test. Test compounds were applied within approximately one day after planting seeds for the preemergence test. Plantings of these crops and weed species were adjusted to produce plants of appropriate size for the postemergence test. All plant species were grown using normal greenhouse practices. Crop and weed species include winter barley (Hordeum vulgare cv. 'Igri'), bedstraw (Galium aparine), blackgrass (Alopecurus myosuroides), chickweed (Stellaria media), downy brome (Bromus tectorum), field violet (Viola arvensis), green foxtail (Setaria viridis), kochia (Kochia scoparia), lambsquarters (Chenopodium album), Persian speedwell (Veronica persica), rape (Brassica napus cv. 'Jet Neuf'), ryegrass (Lolium multiflorum), sugar beet (Beta vulgaris cv. 'US1'), sunflower (Helianthus annuus cv. 'Russian Giant'), spring wheat (Triticum aestivum cv. 'ERA'), winter wheat (Triticum aestivum cv. 'Talent'), wild buckwheat (Polygonum convolvulus), wild mustard (Sinapis arvensis), wild oat (Avena fatua), and wild radish (Raphanus raphanistrum). Blackgrass and wild oat were treated postemergence at two growth stages. The first stage (1) was when the plants had two to three leaves. The second stage (2) was when the plants had

approximately four leaves or in the initial stages of tillering. Treated plants and untreated controls were maintained in a greenhouse for approximately 21 to 28 days, after which all treated plants were compared to untreated controls and visually evaluated. Plant response ratings, summarized in Table G, are based upon a 0 to 10 scale where 0 is no effect and 10 is complete control. A dash response (-) means no test result.

Table G

	COMPOUND	
Rate (125 g/ha)	37	39
POSTEMERGENCE		
Bedstraw	10	10
Blackgrass (1)	8	6
Blackgrass (2)	8	5
Chickweed	10	10
Downy brome	8	7
Field violet	10	7
Green foxtail	6	4
Persn Speedwell	4	8
Rape	10	10
Ryegrass	2	2
Sugar beet	10	10
Sunflower	10	10
Wheat (Spring)	3	3
Wheat (Winter)	2	3
Wild buckwheat	10	9
Wild mustard	10	10
Wild oat (1)	2	5
Wild oat (2)	0	4
Wild radish	10	10
Winter Barley	3	3

Table G

	COMPOUND	
Rate (125 g/ha)	37	39
PREEMERGENCE		
Bedstraw	10	10
Blackgrass (1)	2	0
Blackgrass (2)	2	0
Chickweed	10	9
Downy brome	4	2
Field violet	10	7
Green foxtail	2	2
Persn Speedwell	10	8
Rape	10	10
Ryegrass	4	3
Sugar beet	10	10
Sunflower	7	5
Wheat (Spring)	3	2
Wheat (Winter)	3	2
Wild buckwheat	7	5
Wild mustard	10	10
Wild oat (1)	3	0
Wild oat (2)	2	0
Wild radish	10	9
Winter Barley	4	2

Table G

	COMPOUND			
Rate (64 g/ha)	34	35	37	39
POSTEMERGENCE				
Bedstraw	10	8	10	10
Blackgrass (1)	4	8	6	4
Blackgrass (2)	5	8	5	4
Chickweed	10	10	10	10
Downy brome	9	10	6	5
Field violet	6	5	8	5
Green foxtail	10	9	5	2
Kochia	-	9	-	-
Lambsquarters	10	8	-	-
Persn Speedwell	7	3	3	6
Rape	10	10	10	10
Ryegrass	10	10	0	0
Sugar beet	10	10	10	10
Sunflower	10	10	10	10
Wheat (Spring)	9	10	2	2
Wheat (Winter)	9	10	1	2
Wild buckwheat	10	9	9	8
Wild mustard	10	10	10	10
Wild oat (1)	10	10	0	2
Wild oat (2)	10	10	0	2
Wild radish	10	10	10	10
Winter Barley	10	10	2	2

Table G

	COMPOUND			
Rate (64 g/ha)	34	35	37	39
PREEMERGENCE				
Bedstraw	10	10	10	8
Blackgrass (1)	3	8	0	0
Blackgrass (2)	3	8	0	0
Chickweed	10	10	10	8
Downy brome	6	10	2	0
Field violet	10	10	10	5
Green foxtail	10	10	0	0
Kochia	-	9	-	-
Lambsquarters	-	10	-	-
Persn Speedwell	10	9	10	7
Rape	10	10	10	10
Ryegrass	7	10	2	0
Sugar beet	10	10	10	10
Sunflower	8	10	6	3
Wheat (Spring)	3	9	2	0
Wheat (Winter)	3	8	2	0
Wild buckwheat	4	8	5	3
Wild mustard	10	10	10	10
Wild oat (1)	4	6	0	0
Wild oat (2)	4	6	0	0
Wild radish	9	10	8	7
Winter Barley	5	10	2	0

Table G

	COMPOUND			
Rate (32 g/ha)	34	35	37	39
POSTEMERGENCE				
Bedstraw	10	6	8	8
Blackgrass (1)	3	6	4	2
Blackgrass (2)	4	6	4	2
Chickweed	10	10	10	10
Downy brome	8	10	3	3
Field violet	5	3	6	3
Green foxtail	10	9	4	0
Kochia	-	6	-	-
Lambsquarters	10	6	-	-
Persn Speedwell	5	2	2	4
Rape	10	10	10	10
Ryegrass	10	10	0	0
Sugar beet	10	10	10	10
Sunflower	10	10	10	10
Wheat (Spring)	8	8	0	0
Wheat (Winter)	7	7	0	0
Wild buckwheat	8	7	6	6
Wild mustard	10	10	10	10
Wild oat (1)	8	8	0	0
Wild oat (2)	8	8	0	0
Wild radish	10	10	10	10
Winter Barley	10	10	0	0

Table G

	COMPOUND			
Rate (32 g/ha)	34	35	37	39
PREEMERGENCE				
Bedstraw	10	8	7	6
Blackgrass (1)	2	7	0	0
Blackgrass (2)	2	7	0	0
Chickweed	10	10	9	5
Downy brome	5	10	0	0
Field violet	8	10	9	4
Green foxtail	10	10	0	0
Kochia	-	8	-	-
Lambsquarters	-	10	-	-
Persn Speedwell	10	8	8	5
Rape	10	10	10	9
Ryegrass	4	10	0	0
Sugar beet	10	10	10	10
Sunflower	6	9	1	2
Wheat (Spring)	2	7	0	0
Wheat (Winter)	1	6	0	0
Wild buckwheat	3	6	4	2
Wild mustard	10	10	10	9
Wild oat (1)	2	4	0	0
Wild oat (2)	2	5	0	0
Wild radish	7	10	7	4
Winter Barley	4	10	0	0

Table G

	COMPOUND			
Rate (16 g/ha)	34	35	37	39
POSTEMERGENCE				
Bedstraw	8	4	6	5
Blackgrass (1)	2	3	2	0
Blackgrass (2)	2	4	2	0
Chickweed	9	9	10	7
Downy brome	6	8	0	0
Field violet	4	2	3	2
Green foxtail	10	8	2	0
Kochia	-	4	-	-
Lambsquarters	9	3	-	-
Persn Speedwell	3	0	0	2
Rape	10	10	10	10
Ryegrass	10	8	0	0
Sugar beet	9	9	10	10
Sunflower	10	10	10	10
Wheat (Spring)	5	5	0	0
Wheat (Winter)	5	4	0	0
Wild buckwheat	7	3	4	5
Wild mustard	10	10	10	10
Wild oat (1)	7	7	0	0
Wild oat (2)	6	7	0	0
Wild radish	10	10	10	10
Winter Barley	10	9	0	0

Table G

	COMPOUND			
Rate (16 g/ha)	34	35	37	39
PREEMERGENCE				
Bedstraw	8	6	5	4
Blackgrass (1)	0	4	0	0
Blackgrass (2)	0	5	0	0
Chickweed	8	8	8	3
Downy brome	4	8	0	0
Field violet	5	10	7	2
Green foxtail	7	8	0	0
Kochia	-	6	-	-
Lambsquarters	-	10	-	-
Persn Speedwell	7	7	6	3
Rape	10	10	8	7
Ryegrass	2	9	0	0
Sugar beet	10	10	9	8
Sunflower	4	7	3	0
Wheat (Spring)	0	4	0	0
Wheat (Winter)	0	4	0	0
Wild buckwheat	2	5	2	0
Wild mustard	10	10	9	8
Wild oat (1)	0	2	0	0
Wild oat (2)	0	2	0	0
Wild radish	6	8	6	3
Winter Barley	2	8	0	0

Table G

	COMPOUND			
Rate (8 g/ha)	34	35	37	39
POSTEMERGENCE				
Bedstraw	5	2	4	2
Blackgrass (1)	0	2	0	0
Blackgrass (2)	0	2	0	0
Chickweed	7	8	10	4
Downy brome	4	4	0	0
Field violet	2	0	0	0
Green foxtail	7	5	0	0
Kochia	-	2	-	-
Lambsquarters	7	0	-	-
Persn Speedwell	2	0	0	0
Rape	10	10	10	10
Ryegrass	10	6	0	0
Sugar beet	6	8	10	10
Sunflower	10	10	10	10
Wheat (Spring)	3	3	0	0
Wheat (Winter)	2	2	0	0
Wild buckwheat	4	0	2	2
Wild mustard	10	10	10	8
Wild oat (1)	5	4	0	0
Wild oat (2)	4	5	0	0
Wild radish	10	10	10	10
Winter Barley	8	6	0	0

Table G

	COMPOUND			
Rate (8 g/ha)	34	35	37	39
PREEMERGENCE				
Bedstraw	6	5	3	2
Blackgrass (1)	0	2	0	0
Blackgrass (2)	0	2	0	0
Chickweed	6	7	4	0
Downy brome	2	6	0	0
Field violet	3	9	4	0
Green foxtail	4	6	0	0
Kochia	-	5	-	-
Lambsquarters	-	10	-	-
Persn Speedwell	5	6	3	0
Rape	7	10	6	6
Ryegrass	0	7	0	0
Sugar beet	8	9	7	6
Sunflower	3	6	0	0
Wheat (Spring)	0	3	0	0
Wheat (Winter)	0	2	0	0
Wild buckwheat	0	4	0	0
Wild mustard	8	9	7	6
Wild oat (1)	0	0	0	0
Wild oat (2)	0	0	0	0
Wild radish	4	7	4	0
Winter Barley	0	5	0	0

Table G

	COMPOUND			
Rate (4 g/ha)	34	35	37	39
POSTEMERGENCE				
Bedstraw	3	0	2	0
Blackgrass (1)	0	0	0	0
Blackgrass (2)	0	0	0	0
Chickweed	5	5	10	2
Downy brome	3	2	0	0
Field violet	0	0	0	0
Green foxtail	6	4	0	0
Kochia	-	0	-	-
Lambsquarters	6	0	-	-
Persn Speedwell	0	0	0	0
Rape	10	10	10	10
Ryegrass	7	3	0	0
Sugar beet	4	5	10	8
Sunflower	10	10	10	10
Wheat (Spring)	0	2	0	0
Wheat (Winter)	0	0	0	0
Wild buckwheat	2	0	0	0
Wild mustard	10	10	8	6
Wild oat (1)	3	2	0	0
Wild oat (2)	2	3	0	0
Wild radish	9	10	10	10
Winter Barley	6	3	0	0

Table G

	COMPOUND			
Rate (4 g/ha)	34	35	37	39
PREEMERGENCE				
Bedstraw	3	4	2	0
Blackgrass (1)	0	0	0	0
Blackgrass (2)	0	0	0	0
Chickweed	4	4	2	0
Downy brome	0	3	0	0
Field violet	2	6	2	0
Green foxtail	2	4	0	0
Kochia	-	3	-	-
Lambsquarters	-	7	-	-
Persn Speedwell	3	4	0	0
Rape	6	9	4	4
Ryegrass	0	3	0	0
Sugar beet	7	8	6	4
Sunflower	0	5	0	0
Wheat (Spring)	0	0	0	0
Wheat (Winter)	0	0	0	0
Wild buckwheat	0	3	0	0
Wild mustard	4	8	5	3
Wild oat (1)	0	0	0	0
Wild oat (2)	0	0	0	0
Wild radish	2	5	2	0
Winter Barley	0	4	0	0

Table G

	COMPOUND	
Rate (2 g/ha)	34	35
POSTEMERGENCE		
Bedstraw	2	0
Blackgrass (1)	0	0
Blackgrass (2)	0	0
Chickweed	4	2
Downy brome	2	0
Field violet	0	0
Green foxtail	3	2
Kochia	-	0
Lambsquarters	5	0
Persn Speedwell	0	0
Rape	10	8
Ryegrass	5	2
Sugar beet	2	3
Sunflower	10	10
Wheat (Spring)	0	0
Wheat (Winter)	0	0
Wild buckwheat	0	0
Wild mustard	10	10
Wild oat (1)	2	0
Wild oat (2)	0	0
Wild radish	8	9
Winter Barley	4	2

Table G

	COMPOUND	
Rate (2 g/ha)	34	35
PREEMERGENCE		
Bedstraw	2	3
Blackgrass (1)	0	0
Blackgrass (2)	0	0
Chickweed	2	2
Downy brome	0	0
Field violet	0	4
Green foxtail	0	3
Kochia	-	0
Lambsquarters	-	4
Persn Speedwell	2	2
Rape	4	6
Ryegrass	0	0
Sugar beet	6	6
Sunflower	0	3
Wheat (Spring)	0	0
Wheat (Winter)	0	0
Wild buckwheat	0	2
Wild mustard	2	6
Wild oat (1)	0	0
Wild oat (2)	0	0
Wild radish	0	3
Winter Barley	0	2

Table G

	COMPOUND
Rate (1 g/ha)	34
POSTEMERGENCE	
Bedstraw	0
Blackgrass (1)	0
Blackgrass (2)	0
Chickweed	2
Downy brome	0
Field violet	0
Green foxtail	0
Lambsquarters	3
Persn Speedwell	0
Rape	8
Ryegrass	2
Sugar beet	0
Sunflower	10
Wheat (Spring)	0
Wheat (Winter)	0
Wild buckwheat	0
Wild mustard	10
Wild oat (1)	0
Wild oat (2)	0
Wild radish	6
Winter Barley	2

Table G

	COMPOUND
Rate (1 g/ha)	34
PREEMERGENCE	
Bedstraw	0
Blackgrass (1)	0
Blackgrass (2)	0
Chickweed	0
Downy brome	0
Field violet	0
Green foxtail	0
Lambsquarters	-
Persn Speedwell	0
Rape	3
Ryegrass	0
Sugar beet	4
Sunflower	0
Wheat (Spring)	0
Wheat (Winter)	0
Wild buckwheat	0
Wild mustard	0
Wild oat (1)	0
Wild oat (2)	0
Wild radish	0
Winter Barley	0

TEST H

Seeds of alfalfa (Medicago sativa), bean (Phaseolus vulgaris), bluegrass (Poa pratensis), cabbage (Brassica rapa), carrot (Daucus sativa), corn (Zea mays), flax (Linum usitatissimum), lettuce (Lactuca sativa), lupine (Lupinus albus), oats (Avena sativa), onion (Allium cepa), pea (sativum), peanut (Arachis hypogaea), potato (Solanum tuberosum), rye (Secale cereal), sorghum (Sorghum bicolor), sunflower (Helianthus annuus), and tomato (Lycopersicon esculentum) were planted and treated preemergence with a test chemical dissolved in a non-phytotoxic solvent. These crop species were also treated with postemergence applications of the test chemical. Plants ranged in height from four to twenty cm (two to three leaf stage) when post-emergence applications were applied. Treated plants and controls were grown under greenhouse conditions for approximately twenty-four days, after which all plants treated with the test chemical were compared to untreated controls and visually evaluated for injury response. Application rates for the test chemical are shown in Table H. Plant response ratings, summarized in Table H, are from 0 to 10 where 0 is no injury and 10 is complete control. A dash (-) response means no test result.

Table H

	COMPOUND
Rate (250 g/ha)	5
PREEMERGENCE	
Alfalfa	9
Bean	9
Bluegrass	10
Cabbage	10
Carrott	9
Corn	8
Flax	10
Lettuce	9
Lupine	10
Oats	9
Onion	10
Pea	10
Peanut	9
Potato	10
Rye	10
Sorghum	10
Sunflower	10
Tomato	9

Table H

	COMPOUND
Rate (125 g/ha)	5
POSTEMERGENCE	
Alfalfa	9
Bean	10
Bluegrass	6
Cabbage	9
Carrott	10
Corn	8
Flax	9
Lettuce	9
Lupine	10
Oats	9
Onion	8
Pea	7
Peanut	9
Potato	7
Rye	9
Sorghum	10
Sunflower	10
Tomato	9

Table H

	COMPOUND
Rate (125 g/ha)	5
PREEMERGENCE	
Alfalfa	9
Bean	9
Bluegrass	9
Cabbage	10
Carrott	9
Corn	8
Flax	10
Lettuce	9
Lupine	10
Oats	9
Onion	10
Pea	10
Peanut	9
Potato	9
Rye	10
Sorghum	10
Sunflower	10
Tomato	9

Table H

	COMPOUND
Rate (64 g/ha)	5
POSTEMERGENCE	
Alfalfa	8
Bean	10
Bluegrass	6
Cabbage	9
Carrott	9
Corn	7
Flax	6
Lettuce	9
Lupine	10
Oats	7
Onion	7
Pea	6
Peanut	8
Potato	7
Rye	9
Sorghum	9
Sunflower	10
Tomato	8

Table H

	COMPOUND
Rate (64 g/ha)	5
PREEMERGENCE	
Alfalfa	9
Bean	9
Bluegrass	9
Cabbage	10
Carrott	8
Corn	5
Flax	9
Lettuce	10
Lupine	8
Oats	9
Onion	10
Pea	10
Peanut	9
Potato	9
Rye	10
Sorghum	10
Sunflower	9
Tomato	9

Table H

	COMPOUND
Rate (32 g/ha)	5
POSTEMERGENCE	
Alfalfa	8
Bean	9
Bluegrass	7
Cabbage	6
Carrott	9
Corn	3
Flax	6
Lettuce	10
Lupine	10
Oats	7
Onion	7
Pea	5
Peanut	9
Potato	7
Rye	9
Sorghum	9
Sunflower	10
Tomato	7

Table H

	COMPOUND
Rate (32 g/ha)	5
PREEMERGENCE	
Alfalfa	7
Bean	9
Bluegrass	8
Cabbage	9
Carrott	7
Corn	3
Flax	7
Lettuce	7
Lupine	6
Oats	9
Onion	9
Pea	10
Peanut	7
Potato	8
Rye	9
Sorghum	10
Sunflower	9
Tomato	9

Table H

	COMPOUND
Rate (16 g/ha)	5
POSTEMERGENCE	
Alfalfa	6
Bean	9
Bluegrass	6
Cabbage	7
Carrott	9
Corn	1
Flax	6
Lettuce	9
Lupine	10
Oats	8
Onion	6
Pea	6
Peanut	7
Potato	4
Rye	7
Sorghum	9
Sunflower	10
Tomato	4

Table H

	COMPOUND
Rate (16 g/ha)	5
PREEMERGENCE	
Alfalfa	6
Bean	2
Bluegrass	6
Cabbage	9
Carrott	2
Corn	1
Flax	6
Lettuce	3
Lupine	8
Oats	9
Onion	7
Pea	10
Peanut	6
Potato	6
Rye	9
Sorghum	9
Sunflower	9
Tomato	8

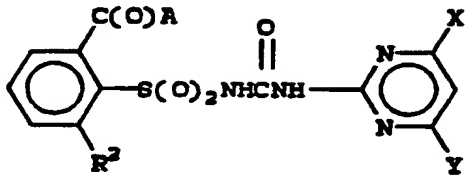
Table H

	COMPOUND
Rate (8 g/ha)	5
POSTEMERGENCE	
Alfalfa	3
Bean	8
Bluegrass	6
Cabbage	2
Carrott	8
Corn	0
Flax	3
Lettuce	9
Lupine	10
Oats	7
Onion	6
Pea	6
Peanut	6
Potato	2
Rye	7
Sorghum	9
Sunflower	10
Tomato	3

CLAIMS

What is claimed is:

1. A compound selected from



I

wherein:

A is OR^1 or $N(CH_3)_2$;

R^1 is C_1-C_3 alkyl, $CH_2CH{=}CH_2$, $CH_2C{\equiv}CH$, CH_2CH_2Cl or $CH_2CH_2OCH_3$;

R^2 is CH_2F, CHF_2, $CHFCH_3$ or CH_2CN;

X is CH_3 or OCH_3; and

Y is H, Cl, CH_3, C_2H_5, OCH_3 or OCF_2H;

and their agriculturally suitable salts; provided that when Y is Cl, then X is OCH_3.

2. A compound of Claim 1 wherein

A is OR^1; and

R^1 is CH_3, CH_2CH_3 or $CH(CH_3)_2$.

3. A compound of Claim 2 wher

wh n on of X and Y is CH_3, th n th other of X and Y is ther than OCH_3.

4. The compound of Claim 1, methyl 3-(cyanomethyl)-2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]benzoate.

5. The compound of Claim 1, methyl 2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]amino]-sulfonyl]-3-(cyanomethyl)benzoate.

6. The compound of Claim 1, methyl 3-(cyanomethyl)-2-[[[[(4-(difluoromethoxy)-6-methoxy-2-pyrimi-dinyl]amino]carbonyl]amino]sulfonyl]-benzoate.

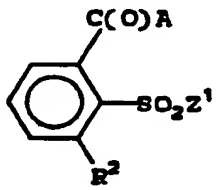
7. The compound of Claim 1, methyl 3-(difluoromethyl)-2-[[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]benzoate.

8. The compound of Claim 1, methyl 3-(fluoromethyl)-2-[[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]benzoate.

9. The compound of Claim 1, methyl 2-[[[[(4,6-dimethoxy-2-pyrimi-dinyl)amino]carbonyl]amino]sulfonyl]-3-(fluoromethyl)benzoate.

10. Th compound f Claim 1, ethyl 2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]amino]-sulfonyl]-3-(fluoromethyl)benzoate.

11. A compound selected from



II

wherein:

A is OR^1 or $N(CH_3)_2$;

R^1 is C_1-C_3 alkyl, $CH_2CH{=}CH_2$, $CH_2C{\equiv}CH$, CH_2CH_2Cl or $CH_2CH_2OCH_3$;

R^2 is CH_2F, CHF_2, $CHFCH_3$ or CH_2CN; and

Z^1 is Cl or $NHSiR^3R^4R^5$;

R^3 is C_1-C_4 alkyl;

R^4 is C_1-C_4 alkyl; and

R^5 is C_1-C_4 alkyl.

12. A compound of Claim 11 wherein A is OR^1 and R^1 is C_1-C_2 alkyl.

13. A compound of Claim 12 wherein R^3 and R^4 are CH_3 and R^5 is $C(CH_3)_3$.

14. A composition suitable for controlling the growth of undesired vegetation which comprises an effective amount of a compound of Claim 1 and at least one of the following: surfactant, solid diluent or liquid diluent.

15. A composition suitable for controlling the growth of undesired vegetation which comprises an effective amount of a compound of Claim 2 and at least one of the following: surfactant, solid diluent or liquid diluent.

16. A composition suitable for controlling the growth of undesired vegetation which comprises an effective amount of a compound of Claim 3 and at least one of the following: surfactant, solid diluent or liquid diluent.

17. A composition suitable for controlling the growth of undesired vegetation which comprises an effective amount of a compound of Claim 4 and at least one of the following: surfactant, solid diluent or liquid diluent.

18. A composition suitable for controlling the growth of undesired vegetation which comprises an effective amount of a compound of Claim 5 and at least one of the following: surfactant, solid diluent or liquid diluent.

19. A method for controlling the growth of undesired vegetation which comprises applying to the locus to be protected an eff ctiv amount of the compound of Claim 1.

20. A method for controlling the growth of undesired vegetation which comprises applying to the locus to be protected an effective amount of the compound of Claim 2.

21. A method for controlling the growth of undesired vegetation which comprises applying to the locus to be protected an effective amount of the compound of Claim 3.

22. A method for controlling the growth of undesired vegetation which comprises applying to the locus to be protected an effective amount of the compound of Claim 4.

23. A method for controlling the growth of undesired vegetation which comprises applying to the locus to be protected an effective amount of the compound of Claim 5.

24. The method of Claim 22 wherein the locus to be protected is corn.

25. A method for controlling the growth of undesired vegetation in wheat or barley which comprises applying to the wheat or barley an effective amount of the compound of Claim 9.

INTERNATIONAL SEARCH REP RT

International Application No PCT/US 91/01075

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: C 07 D 239/42,C 07 D 239/47,C 07 D 239/52, C 07 C 309/89,A 01 N 43/54

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	C 07 D 239/00,C 07 D 251/00,C 07 C 309/00, A 01 N 43/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	EP, A2, 0 096 002 (CIBA-GEIGY) 07 December 1983 (07.12.83), see claims 1,10, 11,12,17.	1,14, 19,24, 25
A	EP, A2, 0 073 627 (DU PONT) 09 March 1983 (09.03.83) see claims 1,25,26.	1,14, 19
X	WO, A1, 89/09 214 (DU PONT) 05 October 1989 (05.10.89), see examples. see claims 1,8,15.	11
A		1,14, 19
A	EP, A1, 0 181 526 (CHUGAI) 21 May 1986 (21.05.86), see claim 1.	11

* Special categories of cited documents: [14]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
15 April 1991	10. 06. 91
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	N. Toribio Nuria TORIBIO

Form PCT/ISA/210 (second sheet) (January 1985)

ANHANG
zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

ANNEX
to the International Search Report to the International Patent Application No.

ANNEXE
au rapport de recherche international relatif á la demande de brevet international n°

PCT/US91/01075 SAE 45036

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The Office is in no way liable for these particulars which are given merely for the purpose of information.

La présente annexe indique les membres de la famille de brevets relatifs aux documents de brevets cités dans le rapport de recherche international visée ci-dessus. Les reseignements fournis sont donnés á titre indicatif et n'engagent pas la responsibilité de l'Office.

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
EP-A1- 181526	21-05-86	AT-E - 40112	15-02-89
		CA-A1- 1255329	06-06-89
		DE-CO- 3567643	23-02-89
		EP-B1- 181526	18-01-89
		JP-A2-61097257	15-05-86
		US-A - 4698364	06-10-87
		JP-A2-61097219	15-05-86
EP-A2- 73627	09-03-83	US-A - 4491467	01-01-85
		AT-E - 23999	15-12-86
		AU-A1-87517/82	03-03-83
		AU-B2- 555081	11-09-86
		BR-A - 8204883	02-08-83
		CA-A1- 1220203	07-04-87
		DE-CO- 3274547	15-01-87
		DK-A - 3754/82	25-02-83
		EP-A3- 73627	28-03-84
		EP-B1- 73627	03-12-86
		ES-A1- 515183	16-10-83
		ES-A1- 8406072	16-10-84
		IL-AO- 66617	31-12-82
		IL-A1- 66617	31-03-86
		JP-A2-58043959	14-03-83
		NZ-A - 201676	31-05-85
		PL-A1- 238013	09-05-83
		US-A - 4555261	26-11-85
		ZA-A - 8206115	28-03-84
EP-A2- 96002	07-12-83	AT-E - 28637	15-08-87
		CA-A1- 1228355	20-10-87
		DE-CO- 3372760	03-09-87
		EP-A3- 96002	25-07-84
		EP-B1- 96002	29-07-87
		IL-AO- 69770	30-09-83
		IL-A1- 68770	29-04-86
		JP-A2-58216167	15-12-83
		US-A - 4537618	27-08-85
		US-A - 4594097	10-06-86
		US-A - 4727186	23-02-88
		ZA-A - 8303779	29-02-84
		IL-AO- 69770	30-12-83
		AU-A1-19566/83	05-04-84
		DD-A5- 207714	14-03-84
		DK-AO- 4389/83	26-09-83
		EP-A2- 111993	27-06-84
		EP-A3- 111993	25-07-84
		FI-AO- 833424	23-09-83
		FI-A - 833424	28-03-84
		GB-AO- 8325360	26-10-83
		GB-A1- 2127408	11-04-84
		GB-B2- 2127408	14-05-86
		IL-AO- 69770	30-12-83
		JP-A2-59080666	10-05-84
		PL-A1- 243905	30-01-85
		PT-A - 77398	01-10-83
		PT-B - 77398	20-03-86
		US-A - 4492708	08-01-85
		ZA-A - 8306958	24-04-85

WO-A1- 8909214	05-10-89	AU-A1-34300/89	16-10-89
		DK-A0- 2288/90	21-09-90
		DK-A - 2288/90	23-11-90
		EP-A1- 336587	11-10-89
		EP-A1- 406322	09-01-91